Route 109 Corridor Planning Study

A report produced by the Central Transportation Planning Staff for the Boston Metropolitan Planning Organization

Route 109 Corridor Planning Study

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1.0 BACKGROUND

Route 109 is a predominantly two-lane arterial that passes through eight communities: Dedham, Westwood, Dover, Walpole, Medfield, Millis, Medway, and Milford. Although Route 109 is a state-numbered route, it is locally controlled, with the exception of the bridge over I-95/Route 128. The roadway is part of the National Highway System (NHS) Program and is eligible for federal funds provided for the program.

The 2000 Congestion Management System (CMS) plan of the Boston Metropolitan Planning Organization identified this corridor as one that is experiencing significant congestion. This finding was confirmed in written and verbal comments from town officials and local citizens. Many of the traffic and congestion issues in Milford, Medway, and Millis were examined in a 2000 CTPS study.[1] However, issues along Route 109 in the other communities in the corridor still need to be identified and addressed. This study is intended to address many of these concerns.

Corridor residents have expressed interest in multimodal solutions to promote safety, efficiency of traffic movement, and local circulation. They have also expressed the desire to maintain the character of the region and avoid solutions that would involve significant additions to existing roadway capacity, require land-takings, or have environmental impacts. This study will attempt to develop strategies that will meet these criteria.

Several community concerns regarding mobility were voiced during meetings with subregional groups [2] and with local officials. Among the potential measures that were advocated are shuttle bus service, park-and-ride lots, and improved amenities for pedestrians and bicyclists. Westwood and Medway officials voiced concerns about several intersections in their communities.

2.0 EXISTING CONDITIONS

2.1 Current and Proposed Projects

The Transportation Improvement Program (TIP) for the Boston region is a staged, multi-year, intermodal program of transportation improvements that must be consistent with the Transportation Plan for the Boston Region. It describes and prioritizes transportation projects expected to be implemented during a three-year period. 2002-2007 projects (endorsed by the Boston region Metropolitan Planning Organization) located on Route 109, including those on the Supplemental List of Active Projects, are shown in Figure 1 (recently completed projects and those under construction are also included). Table 1 lists a description, the TIP status and the estimated cost of each project. With a few exceptions the entire Route 109 corridor in Milford, Medway, and Millis is covered by projects.

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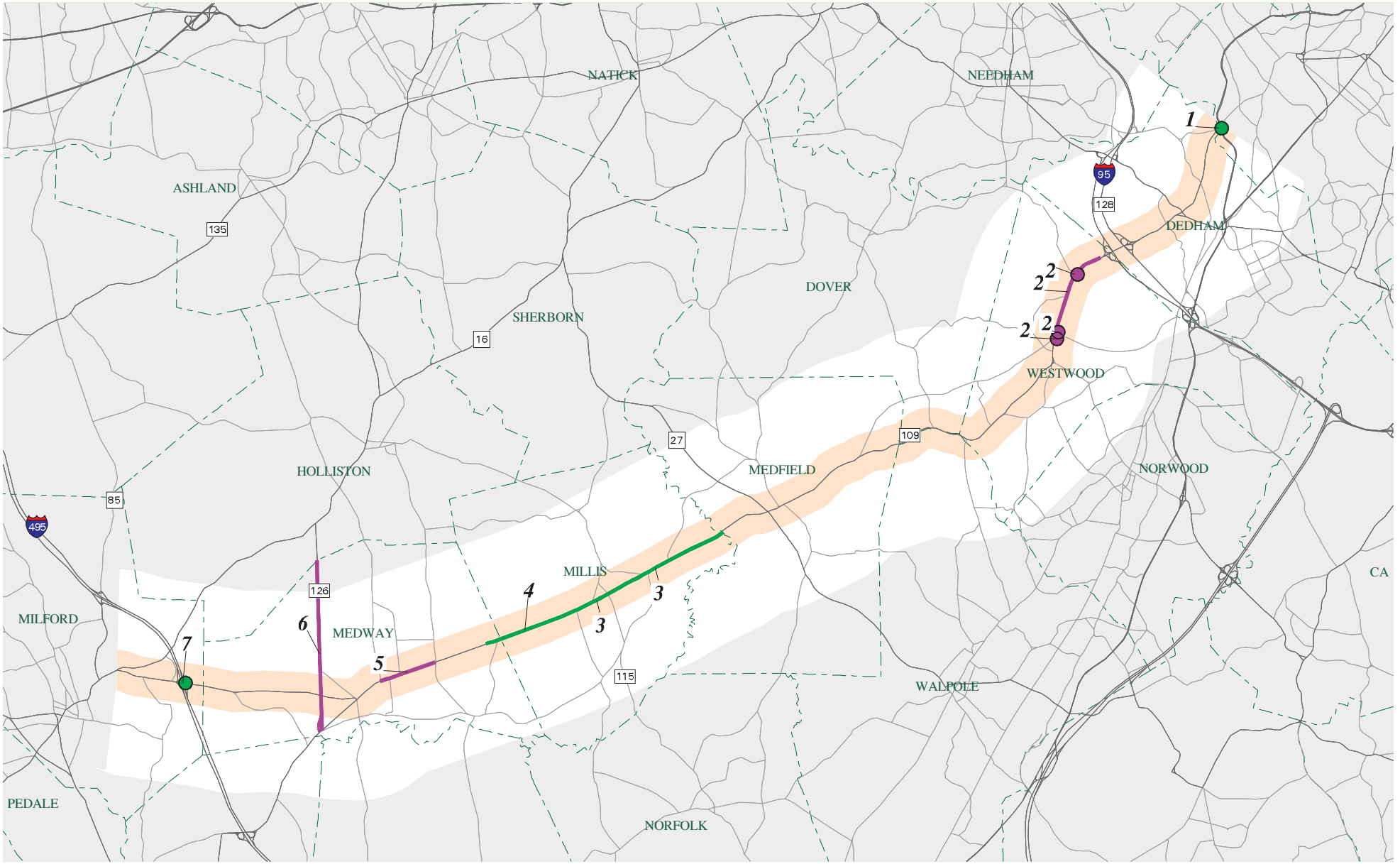
[1] Central Transportation Planning Staff, *Congestion in the SWAP Area: Issues and Potential Responses: Phase I Report of the SWAP Subregional Area Transportation Study*, draft dated July 2000.

[2] The two subregional groups of the Metropolitan Area Planning Council that pertain to the study area: the SouthWest Advisory Planning Committee (SWAP) and the Three Rivers Interlocal Council (TRIC).



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2 ID # for locating project, description in TABLE 1

Programmed in the 2002–2007 TIP, advertised,under construction, or completed

Not currently programmed in the 2002–2007 TIP

FIGURE 1
Status of Route 109
Corridor Projects

TABLE 1
Route 109 Corridor Projects

ID Number in Figure 1	TIP Project Number	Town	Title	Description	Status	Cost
1	602010	Dedham	Route 109 (Bridge Street) Bridge	Rehabilitate the Route 109 (Bridge Street) bridge over the Charles River. (Bridge St./Needham St. intersection added on to project)	Bridge completed	$3,069,847
2	601315	Westwood	Westwood-Route 109 Reconstruction	Reconstruct Route 109 (High Street) from Grove Street to Hartford Street. Project includes intersection improvements.	Programmed in FY 2004 in TIP	$2,500,000
3	601062	Millis	Route 109, Phase 2	Reconstruct Route 109 from Pleasant Street to the Medfield town line. Includes shoulder widening, intersection improvements, improving downtown parking, and replacing traffic signals at the Route 109/Route 115 intersection.	Programmed in FY 2003 in TIP	$4,100,000
4	079800	Medway/Millis	Medway/Millis-Route 109 Reconstruction	Reconstruct Route 109 from Coffee Street in Medway to Spring Street in Millis. Includes shoulder widening, intersection improvements, and signal improvements at Route 109/Pleasant Street and Route 109/Hammond Street.	Under Construction	$3,982,477
5	NA[1]	Medway	Route 109 (Main Street)	Reconstruct Route 109 (Main Street) from Holliston Street to Winthrop Street. This project includes: box-widening of the roadway, modernization of traffic signals to permit left turns, and improvement of pedestrian crossings.	Not yet programmed in TIP	$2,000,000

TABLE 1 (continued)
Route 109 Corridor Projects

ID Number in Figure 1	TIP Project Number	Town	Title	Description	Program Status	Cost
6	602135	Medway	Route 126 (Summer Street)	Reconstruct Route 126 (Summer Street) from the Bellingham town line to the Holliston town line. Work includes: minor widening, traffic signal installation at Route 109, drainage improvements, sidewalk installation, and resurfacing the roadway.	Not yet programmed	$1,400,000
7	601379	Milford	I-495 Ramps-Route 109 (Medway Street)	Install traffic signals and make geometric improvements at the intersection of Route 109 and the Interstate 495 ramps.	Advertised in FY 2001	$525,325

2.2 Public Transportation

Existing public transportation in the Route 109 corridor consists of one private-carrier bus line and three commuter rail lines with stations in the vicinity, but not adjacent to the corridor. All corridor communities except Milford are part of the MBTA district.

2.2.1 Private Carrier Bus Service

The Brush Hill Transportation Company operates one inbound bus trip and one outbound trip along Route 109 between Milford and Boston each weekday. The inbound trip leaves Milford at 6:15 AM and has 4 stops in Milford, 8 in Medway, 8 in Millis, 5 in Medfield, 2 in Dover, 11 in Westwood, and 3 in Boston (at Copley Square, Park Square and South Station). The outbound trip leaves South Station at 4:40 PM. The trips are scheduled to take an hour and 17 minutes from the first to the last stop.

2.2.2 Commuter Rail

Dedham, Westwood, and Walpole are the only corridor communities with direct access to commuter rail with stations on the Franklin Line, which originates at Forge Park in Franklin. According to the 1994 MBTA Commuter Rail Passenger Survey, of the corridor-community residents who use commuter rail:

- 75% use the Franklin Line
- 14% use the South Attleboro/Providence Line
- 8% use the Needham Heights Line
- 3% use the Framingham Line

Approximately 50% of the corridor residents who use commuter rail board at Walpole Station, Dedham Corporate Center Station, and Norwood Central Station. All are on the Franklin Line. Most have parking lots that reach capacity early during the morning peak period.

2.2.3 MBTA Bus and Paratransit

Dedham and Walpole are served by several MBTA bus routes, but none of them is in the vicinity of the corridor. THE RIDE, the MBTA's paratransit service is available in all corridor communities except Millis, Medway, and Milford. THE RIDE provides transportation in lift-equipped vans to people who cannot use general public transportation because of a physical or mental disability.

2.3 Population and Employment

An understanding of population and employment growth in the corridor is important in determining the transportation needs of the corridor, as additional population and, in particular, additional households will produce more trips, while more jobs will attract more commuting trips into the corridor. Corridor employment and population data were

obtained from the Metropolitan Area Planning Council (MAPC), the Massachusetts Department of Employment and Training (DET), and the 2000 U. S. Census.

2.3.1 Population Trends

Tables 2 and 3 present population and households for each corridor community for ten-year increments between 1990 and 2020. Dedham is the only town whose population and households declined in the recent past and are projected to continue to do so between 2000 and 2020. All other communities will grow but at very different rates. The growth rates, however, do appear to be slowing. Population and households grew at a faster rate in the decade between 1990 and 2000 than they are projected to grow in the two decades between 2000 and 2020. The exceptions are Dover and Millis where the growth rate will accelerate. The highest population growth rates are projected to occur in Dover and Medway, the lowest in Milford and Westwood.

Households are projected to grow at a faster rate than population. Corridor population is projected to increase by 8% between 2000 and 2020 while households will grow by 13%. Smaller family size and more single-person households contribute to household growth. The number of households is particularly important to the number of trips originating in a given community, because there are basic trips that each household must make regardless of size.

TABLE 2
Population Trends

Town	Population[1]		Projected Population[2]		Growth		% Growth	
	1990	2000	2010	2020	1990 to 2000	2000 to 2020	1990 to 2000	2000 to 2020
Dedham	23,782	23,464	21,514	20,757	-318	-2,707	-1%	-12%
Dover	4,915	5,558	6,595	7,251	643	1,693	13%	30%
Medfield	10,531	12,273	12,921	13,729	1,742	1,456	17%	12%
Medway	9,931	12,447	14,387	16,172	2,516	3,725	25%	30%
Milford	25,355	26,799	26,676	27,510	1,444	711	6%	3%
Millis	7,613	7,902	8,708	9,304	289	1,402	4%	18%
Walpole	20,212	22,824	24,891	26,644	2,612	3,820	13%	17%
Westwood	12,557	14,117	14,048	14,653	1,560	536	12%	4%
Total	114,896	125,384	129,740	136,019	10,488	10,635	9%	8%

[1]2000 U. S. Census
[2]Metropolitan Area Planning Council

TABLE 3
Household Trends

Town	Households[1]		Projected Households[2]		Growth		% Growth	
	1990	2000	2010	2020	1990 to 2020	2000 to 2020	1990 to 2000	2000 to 2020
Dedham	8,490	8,654	8,127	8,129	164	(525)	2%	-6%
Dover	1,643	1,849	2,316	2,625	206	776	13%	42%
Medfield	3,428	4,002	4,463	4,898	574	896	17%	22%
Medway	3,267	4,182	4,930	5,631	915	1,449	28%	35%
Milford	9,362	10,420	10,337	10,985	1,058	565	11%	5%
Millis	2,749	3,004	3,319	3,687	255	683	9%	23%
Walpole	6,777	8,060	8,766	9,701	1,283	1,641	19%	20%
Westwood	4,444	5,122	5,214	5,616	678	494	15%	10%
Total	40,160	45,293	47,472	51,271	5,133	5,978	13%	13%

2.3.2 Employment Trends

Table 4 summarizes total employment in corridor communities for ten-year increments between 1990 and 2020. Overall, employment increased by approximately 8,100 jobs between 1990 and 2000. Almost three-quarters of this growth occurred in Milford (2,591), Walpole (2,010), and Westwood (1,384). There was minimal growth in Millis and a slight decline in Medfield.

TABLE 4
Employment Trends

Town	Employment[1]		Projected Employment[2]		Growth		% Growth	
	1990	2000	2010	2020	1990 to 2000	2000 to 2020	1990 to 2000	2000 to 2020
Dedham	14,050	14,965	15,668	16,975	915	2,010	7%	13%
Dover	620	828	1,019	1,128	208	300	34%	36%
Medfield	3,509	3,483	3,826	3,972	-26	489	-1%	14%
Medway	1,796	2,750	2,605	2,852	954	102	53%	4%
Milford	11,181	13,772	13,547	14,607	2,591	835	23%	6%
Millis	2,124	2,186	2,326	2,445	62	259	3%	12%
Walpole	7,598	9,608	10,578	11,184	2,010	1,576	26%	16%
Westwood	9,157	10,541	9,522	9,954	1,384	-587	15%	-6%
Total	50,035	58,133	59,091	63,117	8,098	4,984	16%	9%

[1]Massachusetts Department of Employment and Training
[2]Metropolitan Area Planning Council

Employment in the town of Westwood is projected to decrease between 2000 and 2020. During this period, with the exception of Medfield, employment will grow in the other communities, but at a much slower pace. Approximately 5,000 jobs will be created in corridor communities during the 20-year period, compared with the approximately 8,100 jobs created during the preceding 10 years. Almost three-quarters (72%) of the growth is projected to occur in Dedham and Walpole.

2.3.3 Work Trips Produced in and Attracted to Corridor Communities

U. S. Census journey-to-work data is the primary source of information on how people travel to their places of employment. The 1990 Census provides the latest available information on these trips. 2000 Census journey-to-work data will not be available until the summer of 2003. Economic and employment characteristics have changed since 1990. Therefore, the analyses in this section should be viewed as a benchmark with which to compare 2000 Census data when it becomes available.

The distribution of journey-to-work trips from corridor communities to places of employment and to employment in corridor communities by modes of travel is presented in Tables 5 and 6 respectively. Note that the total number of trips to employment in the corridor is slightly different from the DET corridor employment total. Some of the difference can be attributed to the fact that the DET numbers do not include all job categories (e.g. self-employed and certain domestic services).

TABLE 5
1990 Work Trips by Town of Employment

Town	Total Trips	Drive Alone	2+ Carpool	Bus	Cmtr. Rail	Bike	Walk	Work at Home	Other
Dedham	14,370	81.1%	10.0%	3.4%	0.3%	0.1%	2.5%	2.3%	0.3%
Dover	1,114	81.0%	3.2%	0.5%	0.0%	0.0%	2.1%	12.6%	0.6%
Medfield	4,008	82.7%	9.4%	0.0%	0.4%	0.4%	1.6%	4.9%	0.6%
Medway	2,330	83.0%	10.0%	0.5%	0.0%	0.2%	3.0%	2.9%	0.3%
Milford	12,455	83.4%	9.8%	0.2%	0.0%	0.1%	3.9%	2.4%	0.2%
Millis	2,306	77.4%	11.7%	0.8%	1.0%	0.5%	2.7%	4.3%	1.6%
Walpole	7,692	82.2%	9.6%	1.5%	0.4%	0.1%	2.2%	3.6%	0.5%
Westwood	8,710	84.8%	10.2%	0.4%	0.4%	0.1%	1.2%	2.8%	0.2%
Total	52,985	82.5%	9.8%	1.3%	0.3%	0.1%	2.5%	3.1%	0.4%

Source: 1990 U.S. Census

TABLE 6
1990 Work Trips by Town of Residence

Town	Total Trips	Drive Alone	2+ Carpool	Bus	Cmtr. Rail	Bike	Walk	Other
Dedham	11,680	80.0%	8.6%	3.1%	4.6%	0.3%	3.2%	0.4%
Dover	2,255	84.1%	5.6%	2.3%	6.8%	0.5%	0.7%	0.0%
Medfield	5,392	84.3%	7.2%	0.5%	4.7%	0.3%	2.0%	1.0%
Medway	5,053	85.6%	9.1%	0.2%	2.5%	0.1%	1.5%	1.0%
Milford	12,461	83.0%	12.2%	0.3%	0.7%	0.2%	3.4%	0.3%
Millis	4,190	87.5%	7.4%	0.5%	1.6%	0.3%	1.7%	1.1%
Walpole	10,256	82.5%	8.1%	0.6%	6.3%	0.1%	1.9%	0.5%
Westwood	6,039	84.2%	6.1%	1.7%	5.8%	0.0%	1.8%	0.4%
Total	57,222	83.3%	8.8%	1.2%	3.9%	0.2%	2.4%	0.5%

Source: 1990 U.S. Census

The auto is the dominant mode for both those working and living in the corridor. Eighty-two percent of those who work in the corridor communities drive alone to work. Eighty-three percent of those who live in the corridor drive alone to work. Less than 3% of those who work in the corridor arrive by public transportation, while 5% of those who live in the corridor travel to work by public transportation. It is noteworthy that almost 12% of those employed in the town of Dover work at home.

2.3.4 Where People are Employed

Table 7 shows where trips produced in the corridor are going and how they get there. A total of 58% of the trips are destined for either Inner Core communities (28%) or TRIC communities (30%). Most of the work trips are made by auto, either driving alone or participating in a carpool. However, 15% of the trips going to Inner Core communities are made on public transportation.

Over half (53%) of the trips to the Inner Core are destined for Boston. Table 8 shows modes of travel for work trips to Boston from each corridor community. Except for a bus making one round-trip per day, neither Dover nor Medway has direct access to public transportation; however, more than one third of work trips from each community is made on public transportation. Dedham, Walpole, and Westwood have commuter rail stations; Dedham and Walpole also have MBTA bus service. Of the work trips to Boston from these 3 communities, 21%, 33%, and 31% respectively are made on public transportation. At 19%, the town of Milford has the highest carpool mode share.

TABLE 7
1990 Work Trips by Mode to MAPC Subregions and Elsewhere from Corridor Communities[1]

Location of Employment	Total Trips	% Total	Drive Alone	2+ Carpool	Bus/ Subway	Commuter Rail	Bike	Other
Inner Core	16,363	28%	74%	9%	3%	12%	0%	1%
Magic	887	2%	96%	4%	0%	0%	0%	0%
MetroWest	6,504	11%	91%	8%	0%	0%	0%	0%
NSPC	661	1%	90%	7%	1%	0%	0%	0%
NSTF	365	1%	81%	15%	0%	0%	2%	2%
South Shore	492	1%	88%	8%	2%	0%	0%	0%
SWAP	9,688	17%	84%	10%	0%	0%	0%	5%
TRIC	17,261	30%	86%	9%	0%	0%	0%	4%
Other MA	4,611	8%	90%	8%	0%	0%	0%	1%
Rhode Island	246	0%	100%	0%	0%	0%	0%	0%
Other-States	499	1%	72%	8%	3%	0%	0%	15%
Total[2]	57,577	100%	83%	9%	1%	4%	0%	2%

[1]Source: 1990 U.S. Census.
[2]Some trips are double counted, because several communities are part of two subregions.

TABLE 8
1990 Travel Mode to Work in Boston

Town	Total Trips	Drive Alone	2+ Carpool	Bus	CRR	Bike	Walk	Other
Dedham	3,451	69%	9%	6%	15%	0%	1%	0%
Dover	540	54%	8%	8%	28%	2%	0%	0%
Medfield	498	68%	8%	3%	19%	0%	1%	0%
Medway	333	59%	8%	4%	30%	0%	0%	0%
Milford	648	65%	19%	4%	12%	0%	0%	0%
Millis	572	70%	12%	4%	12%	0%	2%	0%
Walpole	1,321	59%	5%	3%	31%	0%	1%	1%
Westwood	1,282	62%	7%	5%	26%	0%	0%	1%
Total	8,645	65%	9%	5%	20%	0%	1%	0%

Source: 1990 U.S. Census.

3.0 TRAFFIC FLOW THROUGH THE CORRIDOR

3.1 Average Daily Traffic

The Massachusetts Highway Department's continuous traffic count program consists of 212 stations counted hourly every day of the year. Its coverage count program consists of 2,242 counts spread across a three-year counting cycle. Each coverage count is of a 48-hour duration and is repeated once every three years.[3] These counts are used to develop average daily traffic (ADT) counts. ADT is the average 24-hour traffic volume at a given location. There are no continuous counts on Route 109; coverage counts are done at the following 5 locations:

- Medfield, east of Brook Street
- Millis, east of Route 115
- Medway, at the Millis town line
- Milford, at the Medway town line
- Milford, west of I-495

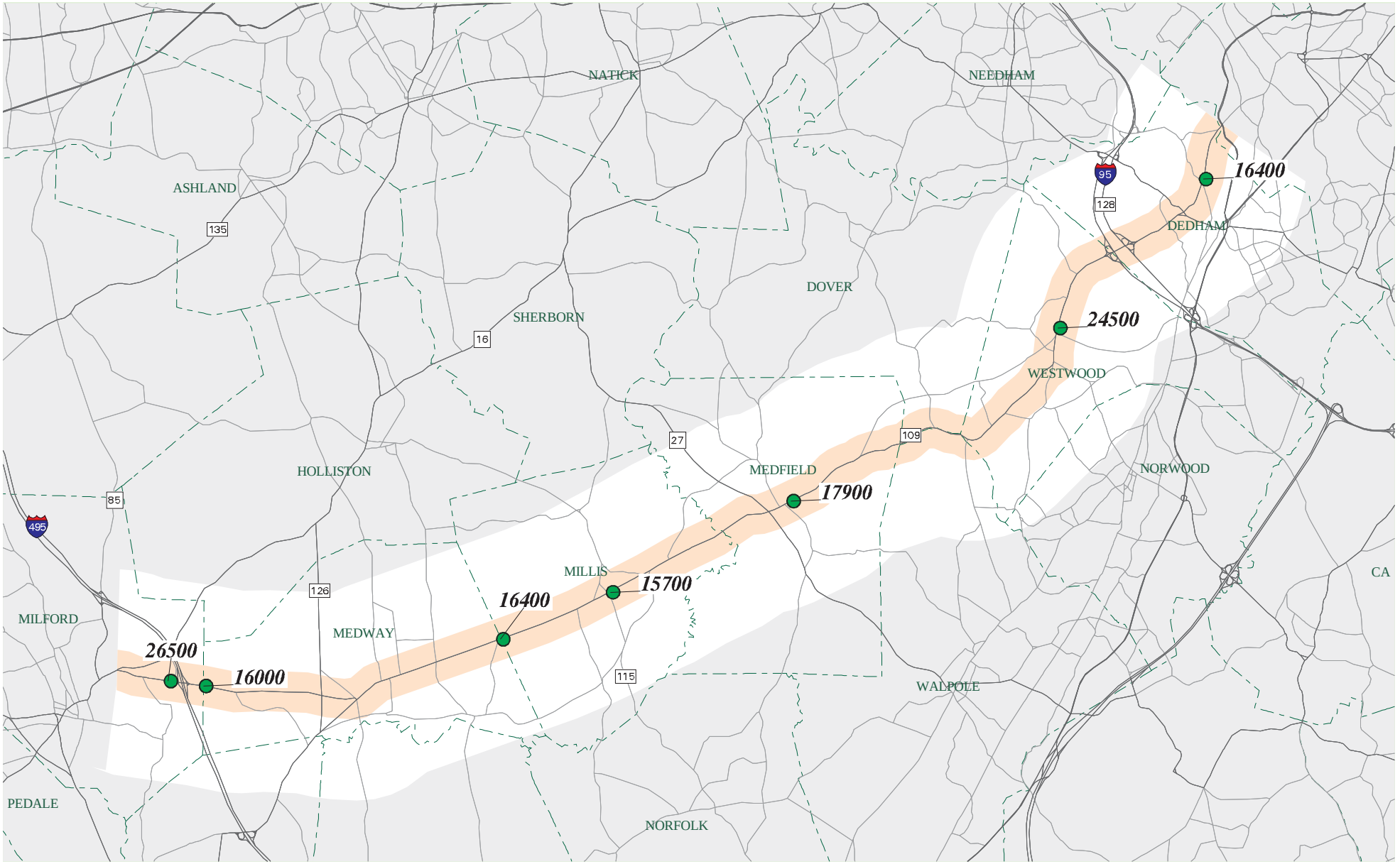
Figure 2 shows 1999/2000 ADT (the latest available data) for these locations and two others-Route 109 north of Bingham Avenue in Dedham and Route 109 north of Windsor Road in Westwood-for which estimates were made from 24-hour counts performed by the Norfolk County Engineers. The ADT ranges from 15,700 east of Route 115 in Millis to 26,500 in Milford west of I-495.

Historical data is presented in Figure 3 for the five coverage locations. ADT grew during the eighties, peaked during the mid-nineties, and remained fairly constant at most locations during the late nineties. The exceptions are Route 109 in Milford at the Medway town line, where ADT has increased gradually, and Route 109 in Medfield east of Brook Street, where ADT increased by 87% between 1988 and 1997 but has since decreased. The constant ADT might indicate that the roadway is at capacity during peak periods.

3.2 Peak-Hour Traffic

Traffic volumes are heaviest during periods in which people travel to and from work. Analyzing these volumes, particularly those at signalized intersections where most of the delay occurs, can be helpful in creating a picture of where vehicles enter and exit the corridor. The original intent of this study was to collect existing counts from communities along the corridor. Most communities did not have current counts; therefore, CTPS performed turning-movement counts at many of the corridor's signalized intersections in November 2001 and January 2002. AM and PM peak-hour counts are shown in Figure 4. In addition to providing the volume for each movement, the figure presents for each location the total Route 109 volume in each direction to show the progression of traffic through the corridor.

[3] Massachusetts Highway Department, *2000 Traffic Volumes for the Commonwealth of Massachusetts*, p. ii.



CTPS

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ADT Volume
Count Location

FIGURE 2
Average Daily Traffic (ADT) Volumes, 1999/2000

FIGURE 3
Route 109 Historical Average Daily Traffic (ADT)

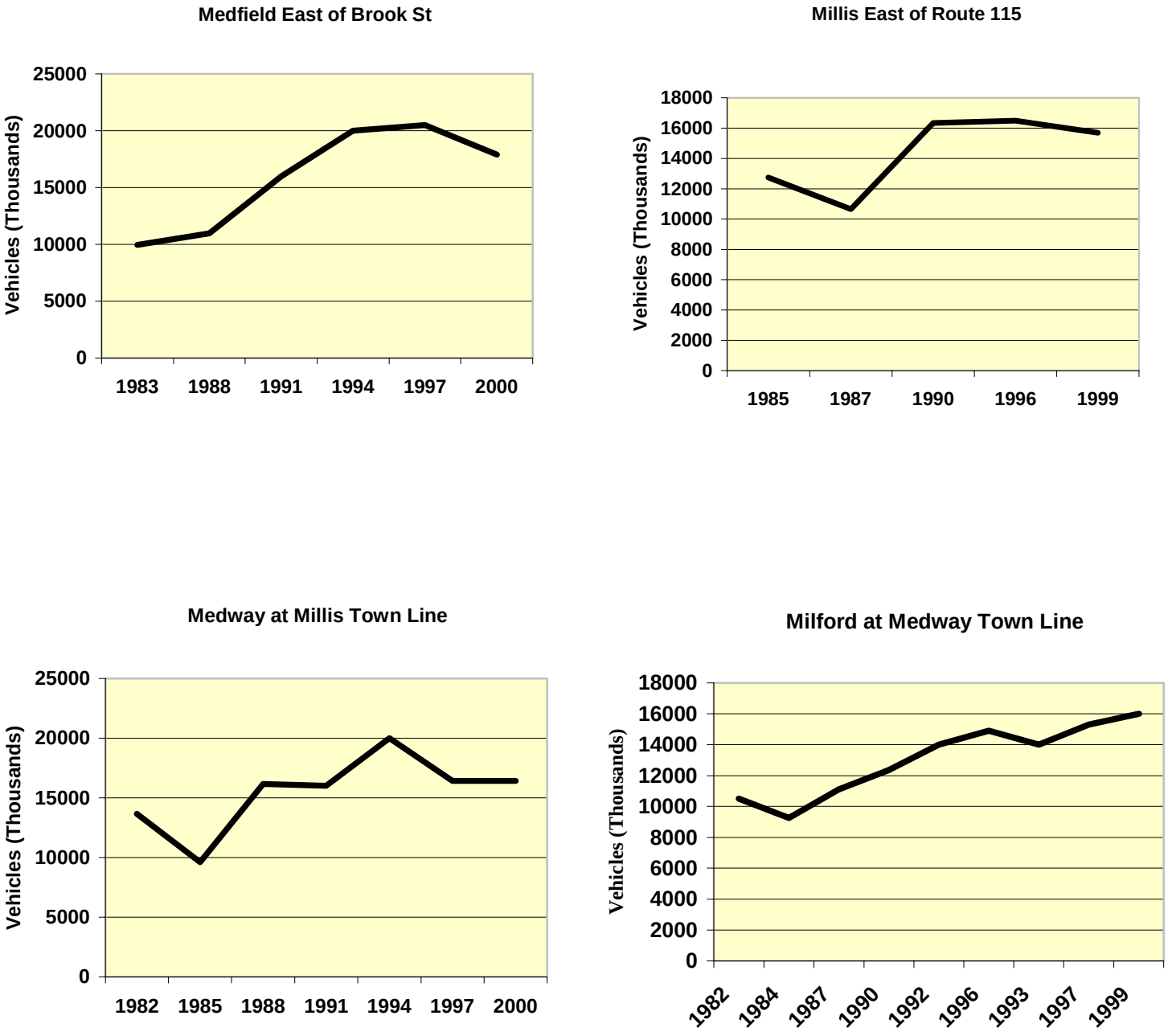
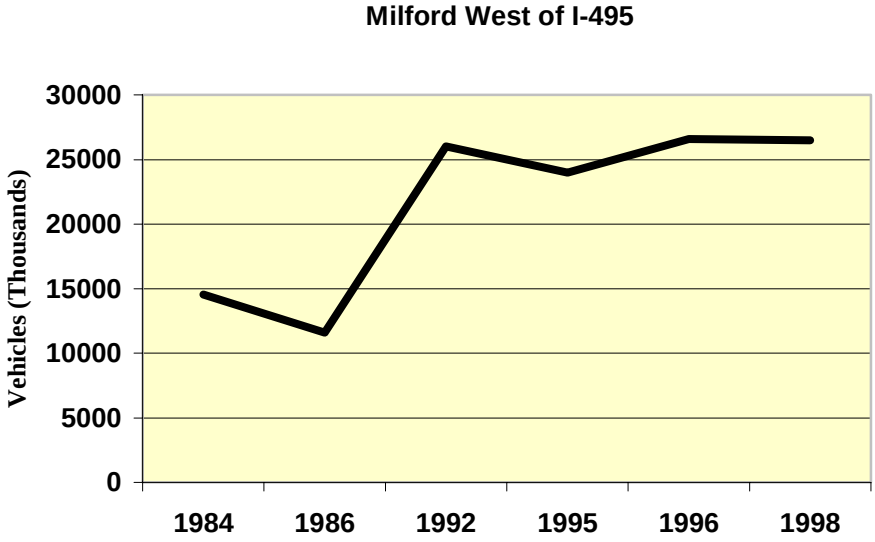


FIGURE 3 (Continued)
Route 109 Historical Average Daily Traffic (ADT)



During the past several years, there have been a number of construction projects on Route 109 particularly in Dedham, Westwood, Medfield, and Millis. These projects might have affected some of the CTPS traffic counts performed for this study if drivers sought alternate routes to avoid construction delays. A comparison of MassHighway's 1997 and 2000 counts on Route 109 east of Brook Street in Medfield reveals a 12.6 % decrease in ADT. The lower volume could be attributed to a number of things including the state of the economy and several construction projects in Medfield between 1998 and 2002. Because traffic enters the roadway at various points, some of which are not impacted by construction, counts might not be equally affected. Some might be lower than normal while others might be unaffected.

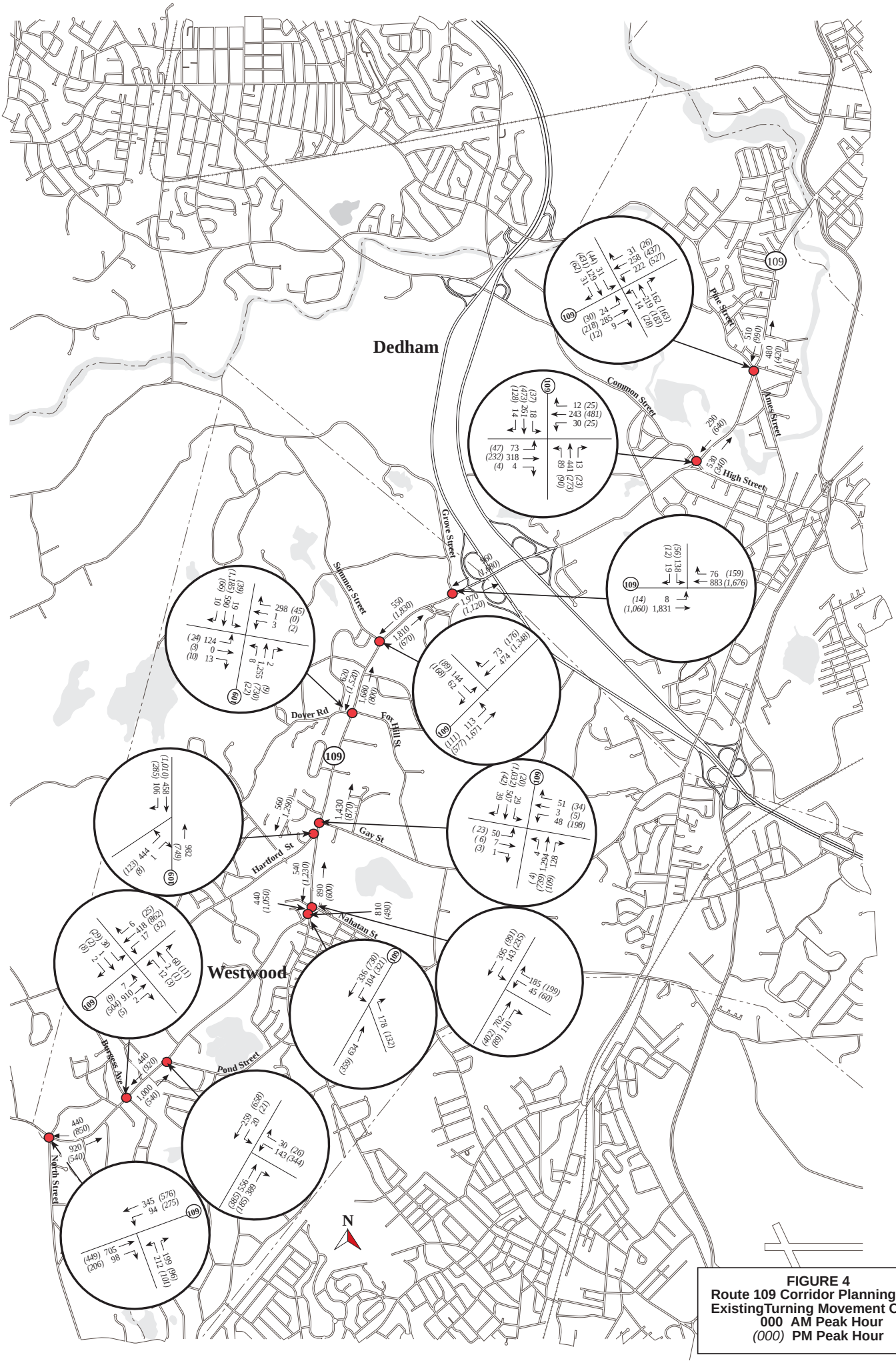


FIGURE 4
Route 109 Corridor Planning Study
ExistingTurning Movement Counts
000 AM Peak Hour
(000) **PM Peak Hour**

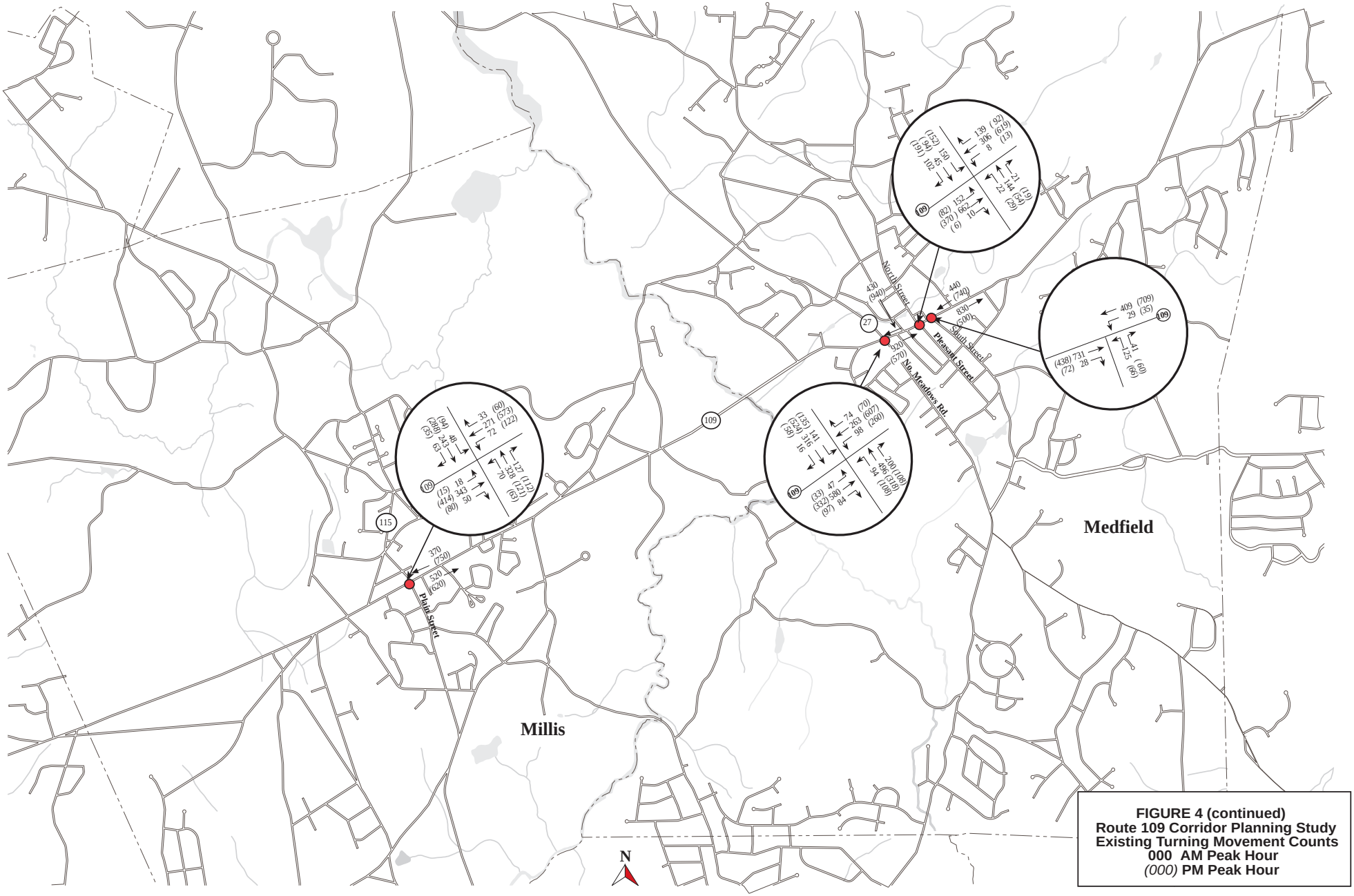


FIGURE 4 (continued)
Route 109 Corridor Planning Study
Existing Turning Movement Counts
000 AM Peak Hour
(000) **PM Peak Hour**

FIGURE 4 (continued)
Route 109 Corridor Planning Study
Existing Turning Movement Counts
000 AM Peak Hour
***(000)* PM Peak Hour**

The eastbound direction is dominant at all locations in the AM peak hour. The volume increases substantially in Westwood and then decreases by two-thirds (68%) after many vehicles exit to Route 128. The lightest eastbound volumes occur in Dedham. Because of the way the volumes increase and decrease throughout the corridor, it appears that a majority of the vehicles do not travel the length of the corridor

As in the AM, the PM peak-hour traffic is directionally peaked, the heavier traffic flow being in the westbound direction. Westbound traffic increases substantially after Route 128, with the heaviest traffic occurring in Westwood.

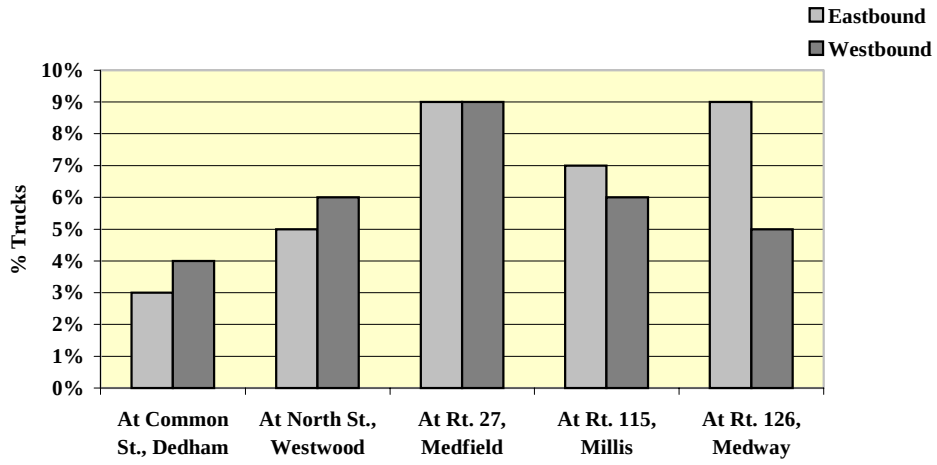
3.3 Truck Traffic

Several communities have expressed concern about the number of heavy trucks moving through the corridor. Therefore, a vehicle classification count was conducted on Route 109 at the following locations in conjunction with the AM peak period turning movement counts:

- Route 126 in Medway
- Route 115 in Millis
- Route 27 in Medfield
- North Street in Westwood
- Common Street in Dedham

The count assigned vehicles to one of three categories: autos/light trucks, buses, and all other trucks. Figure 5 shows trucks (other than light trucks) as a percentage of AM peak hour eastbound and westbound traffic. The percentages for the five locations range between 3% and 9% in the eastbound direction and between 4% and 9% westbound. These percentages are generally higher than in 1978, when a similar count was performed.

Figure 5
% Truck Traffic on Route 109 during the AM Peak Hour



4.0 ORIGIN-DESTINATION ANALYSIS

The towns of origin of vehicles that use Route 109, and the vehicles' paths through the corridor, were determined through a license plate survey. The likely destinations of vehicles were identified using the CTPS regional traffic model.

4.1 License Plate Survey

A license plate survey was conducted at five locations in the study area (Table 9) on April 9, 2002, between 6:40 AM and 9:15 AM to determine the origins of vehicles and their paths through the corridor. The locations were chosen to gain general information and to address corridor communities' concerns regarding "by-pass" traffic.

The steps used to collect and process the data and the findings are discussed in the following sections.

4.1.1 Data Collection

CTPS personnel used special-purpose video camcorders to record images of the license plates of vehicles passing survey locations 1, 3, 4, and 5. An audio tape recorder was used to record plate numbers at location 2. The survey was conducted on the same morning at all five locations. The starting and ending times of surveying at the various locations were staggered to enable the survey to follow a vehicle entering the system in Milford and possibly not exiting the system before Westwood. The cameras were mounted on heavy-duty tripods located adjacent to the roadway lane serving traffic moving in the primary travel direction. Each camera was aimed and focused to record images of the rear license plates of vehicles moving in the primary direction. The person recording data on a tape recorder was positioned to allow the best view of rear plates.

The University of Massachusetts at Amherst Transportation Center transcribed the video taped plate numbers. The recordings were played back using tape decks designed to produce sharp, jitter-free images on a video monitor. An operator read each legible plate image and entered the alphanumeric characters into a computer file for each videotaped location. In the case of the audiotaped location, CTPS transcribed the license plates. An equipment problem at location 5 limited the number of readable plates. Even though all license plates could not be read, an accurate count of vehicles passing each survey location in each direction was obtained from the videotapes. In the survey as a whole, 86% of the passing vehicles' plate numbers were successfully "read". The individual location "read rates" ranged from 39% to 97%.

4.1.2 Data Analysis and Findings

The observed license plate data was matched with Registry of Motor Vehicles files to determine the community in which each vehicle is garaged. This data was used as a surrogate for trip origins. Overall, the plates of 64% of the observed vehicles were matched. The plate match rates ranged from a low of 25% at the location near Trettel

Drive in Milford where technical difficulties occurred, to a high of 94% at Hartford Street in Westwood.

Table 9 presents, for each survey location, total vehicles observed, number of plates read, number of plates matched, and the margin of error for the 95% confidence level for the origin data. The latter means that for a given location, the estimate of the proportion of the total vehicles originating in any given community falls within the range of plus or minus the margin of error 95% of the time. For example, it is estimated that 18.6% of the vehicles observed at location 1 traveling eastbound are from Westwood and the margin of error for that location is ± 1.3%; therefore, 95% of the time, the proportion of vehicles from Westwood would range between 17.3% and 19.9%. (In other words, if this survey were conducted 100 times, 95 of those times the percentage of vehicles from Westwood would be within 1.3 points of the percentage found in this survey.) A conservative method was used to estimate the margins of error. Therefore, the actual margins of error are probably slightly smaller than those that appear in the table.

TABLE 9
License Plate Survey Statistics

Location Number and Name	Observed Traffic	Plates Read	Read Rate	Plates Matched[1]	Match Rate	Margin of Error[2]
1 Route 109 EB at Westwood Town Hall	2,336	2,241	95%	1,640	70%	±1.3%
2 Hartford St. EB at Route 109 in Westwood	696	654	94%	652	94%	±1.0%
3 Route 109 EB across from Bridge St. in Medfield	1,258	1,216	97%	842	67%	±1.9%
4 Village St. NB at Route 109 in Millis	847	697	82%	481	57%	±2.9%
5 Route 109 EB near Trettel Dr. in Milford[3]	940	364	39%	238	25%	±5.5%
Total	6,077	5,172	86%	3,853	64%	

[1]Plates matched with Registry of Motor Vehicle files for town of origin
[2]Margin of error for 95% confidence level
[3]Plates were not readable for a portion of the period

The following two sections discuss the findings derived from the survey. The first section discusses the origins of the vehicles observed; the second discusses the movement of vehicles within and through the study area.

Origins of Observed Vehicles

Survey findings relating to the origin of observed vehicles are presented in detail in Figure 6. This section summarizes origin data for each location.

- *Location 1, Route 109 Eastbound at Westwood Town Hall*

  Over half (57%) of the vehicles observed at location 1 originated in five communities: Westwood (19%), Medfield (13%), Walpole (11%), Norwood (9%), and Norfolk (5%). The remainder originated in a large number of communities that individually contributed between 1% and 4% of the total.

- *Location 2, Hartford Street Eastbound at Route 109 in Westwood*

  Hartford Street intersects Route 109 in Medfield and in Westwood. Medfield, Dover, and Westwood are the only communities with either direct or fairly direct access to this street. However, these towns account for only 45% of the vehicles observed at this location. Approximately 30% of the vehicles originated in communities south of Route 109 or communities that abut Route 109 west of the Hartford Street Route/109 intersection in Medfield.

- *Location 3, Route 109 Eastbound at Bridge Street in Medfield*

  This location is neither a corridor entry/exit point nor a Route 109-bypass point. The survey did not yield unexpected data for this location. Sixty percent of the vehicles originated in the town of Millis and surrounding communities.

- *Location 4, Village Street Northbound at Route 109 in Millis*

  The majority of vehicles (65%) at this location originated in Franklin (26%), Millis (16%), Norfolk (10%), Medway (10%), and Bellingham (3%). Village Street passes through two of these communities, and the other three communities which are located south of the street, have streets that intersect Village. It appears that motorists from these communities use this roadway as a means to get to Route 109.

- *Location 5, Route 109 Eastbound near Trettel Drive in Milford*

  This location is one of the major entry points to the corridor. Although there were equipment problems at this location during the survey, valid conclusions can still be made. As is typical of locations of this type, the origins are quite diverse. Milford (25%) and Medway (8%) have the highest concentrations.

Origins of Vehicles Observed at More than One Location

The towns of Medway and Westwood expressed concerns about "by-pass" traffic. An objective of the license plate survey was to determine if motorists use Village Street in Medway and Hartford Street in Medfield and Westwood to by-pass traffic on Route 109. This can be determined by tracking vehicles through the corridor. The number of vehicles passing by two or more of the survey locations was calculated by matching the file of license plate records associated with the upstream location (the location passed first) against the records in the file associated with the next location downstream. This process

created a five by five matrix of from-to movements, only ten of which are actually possible. These movements were then expanded to the control totals to compensate for the plates that could not be read. The expanded matrix appears in Table 10 and graphically in Figures 7-10.

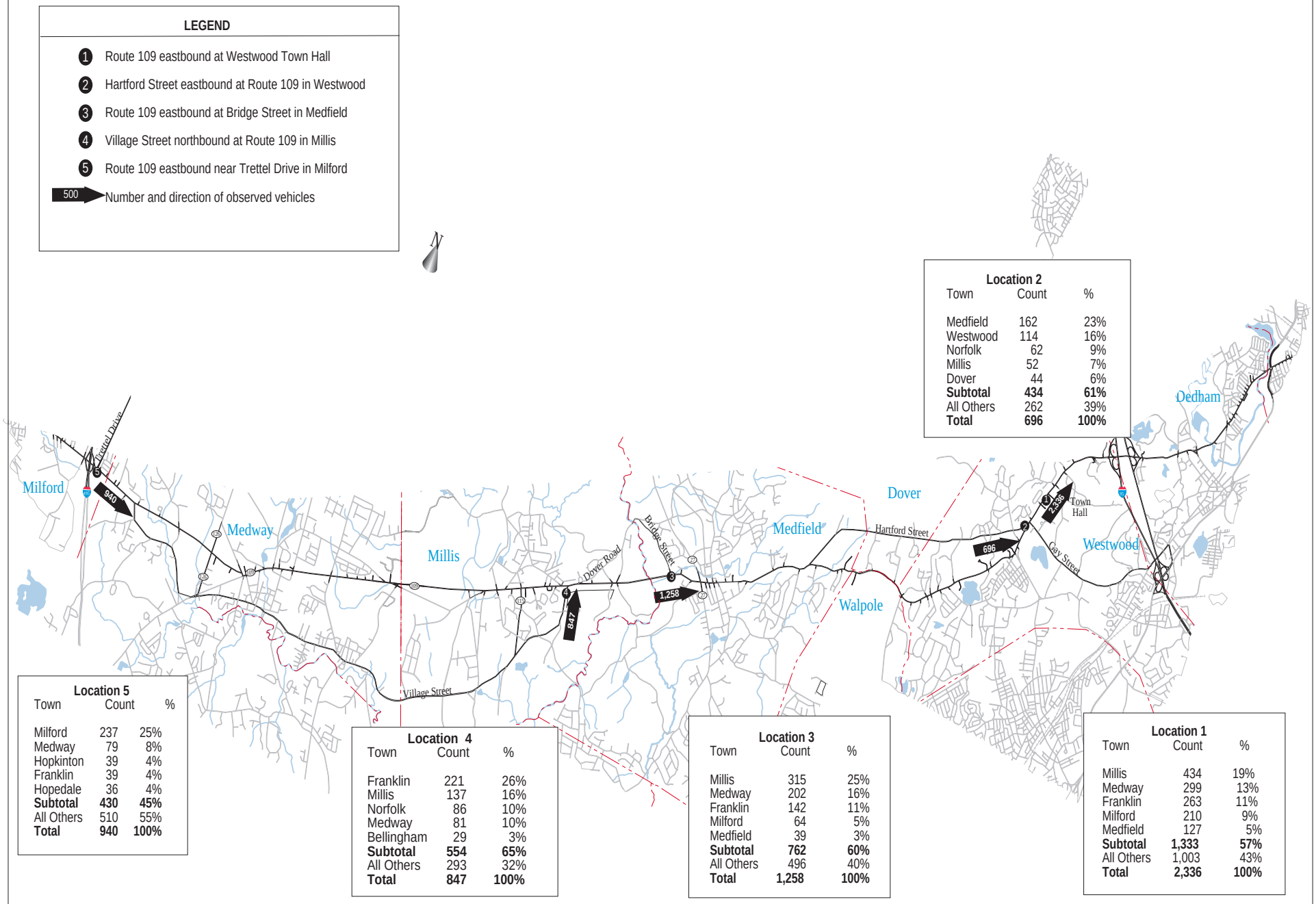
It appears that few vehicles leave Route 109 to use Village Street to by-pass Route 109 traffic, as indicated by the location 5 to location 4 match in Table10. In addition, this matrix indicates that the majority of vehicles observed in Milford (location 5) leave Route 109 before Bridge Street in Medfield (location 3). Possible exit points include Route 126 and Holliston Street in Medway and Route 115 in Millis.

TABLE 10
Adjusted Origin-Destination Matches

				To Locations				
				1	**2**	**3**	**4**	**5**
		Observed Traffic		2,336	696	1,258	847	940
			Read Rate	0.95	0.94	0.97	0.82	0.39
From Locations	**1**	2,336	0.95					
	2	696	0.94	413 (59%)				
	3	1,258	0.97	371 (29%)	109 (9%)			
	4	847	0.82	86 (10%)	40 (5%)	223 (26%)		
	5	940	0.39	22 (2%)	3 (0%)	79 (8%)	3 (0%)	

Only 26% of the vehicles observed on Village Street in Millis (location 4) were observed at location 3 on Route 109 in Medfield. These locations are less than two miles apart, and no major roadways intersect Route 109 between them. One possible explanation is that many vehicles exit Route 109 onto Dover Road in Millis to get to Route 27 or other streets that will take them north particularly to destinations in MetroWest.

The survey data indicate that approximately 9% of the vehicles observed on Route 109 at Bridge Street in Medfield (location 3) use Hartford Street in Medfield and Westwood to bypass traffic on Route 109, as they were observed again on Hartford Street at Route 109 in Westwood (location 2). Most of these vehicles also were observed on Route 109 in front of the Westwood town hall (location 1). The number of vehicles using Hartford Street as a bypass is probably higher than can be determined with this analysis, because vehicles that entered Route 109 east of Bridge Street (location 3) that also used Hartford Street can not be isolated. As discussed earlier, 30% of the vehicles observed at the Hartford Street location originated in communities south of Route 109 and in communities that abut Route 109 south of Hartford Street in Medfield. Logically, these vehicles would continue on Route 109 once they reached the roadway. However, the majority, if not all, of these vehicles used Hartford Street to by-pass Route 109.



Location 2

Town	Count	%
Medfield	162	23%
Westwood	114	16%
Norfolk	62	9%
Millis	52	7%
Dover	44	6%
Subtotal	**434**	**61%**
All Others	262	39%
Total	**696**	**100%**

Location 5

Town	Count	%
Milford	237	25%
Medway	79	8%
Hopkinton	39	4%
Franklin	39	4%
Hopedale	36	4%
Subtotal	**430**	**45%**
All Others	510	55%
Total	**940**	**100%**

Location 4

Town	Count	%
Franklin	221	26%
Millis	137	16%
Norfolk	86	10%
Medway	81	10%
Bellingham	29	3%
Subtotal	**554**	**65%**
All Others	293	32%
Total	**847**	**100%**

Location 3

Town	Count	%
Millis	315	25%
Medway	202	16%
Franklin	142	11%
Milford	64	5%
Medfield	39	3%
Subtotal	**762**	**60%**
All Others	496	40%
Total	**1,258**	**100%**

Location 1

Town	Count	%
Millis	434	19%
Medway	299	13%
Franklin	263	11%
Milford	210	9%
Medfield	127	5%
Subtotal	**1,333**	**57%**
All Others	1,003	43%
Total	**2,336**	**100%**

FIGURE 6
License Plate Survey
Observed Traffic Volumes and Major Origin Communities
AM Peak Period, April 9, 2002

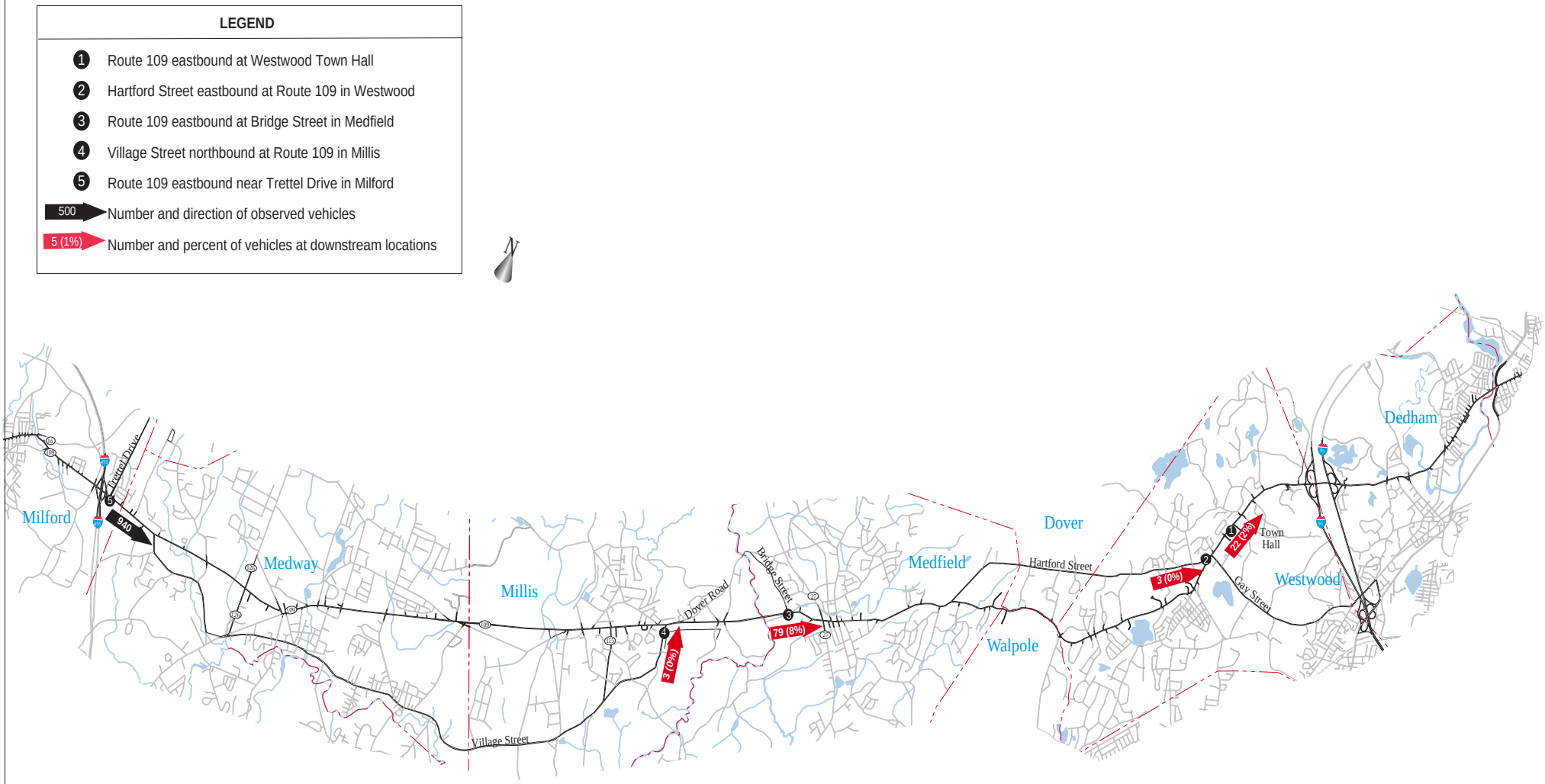


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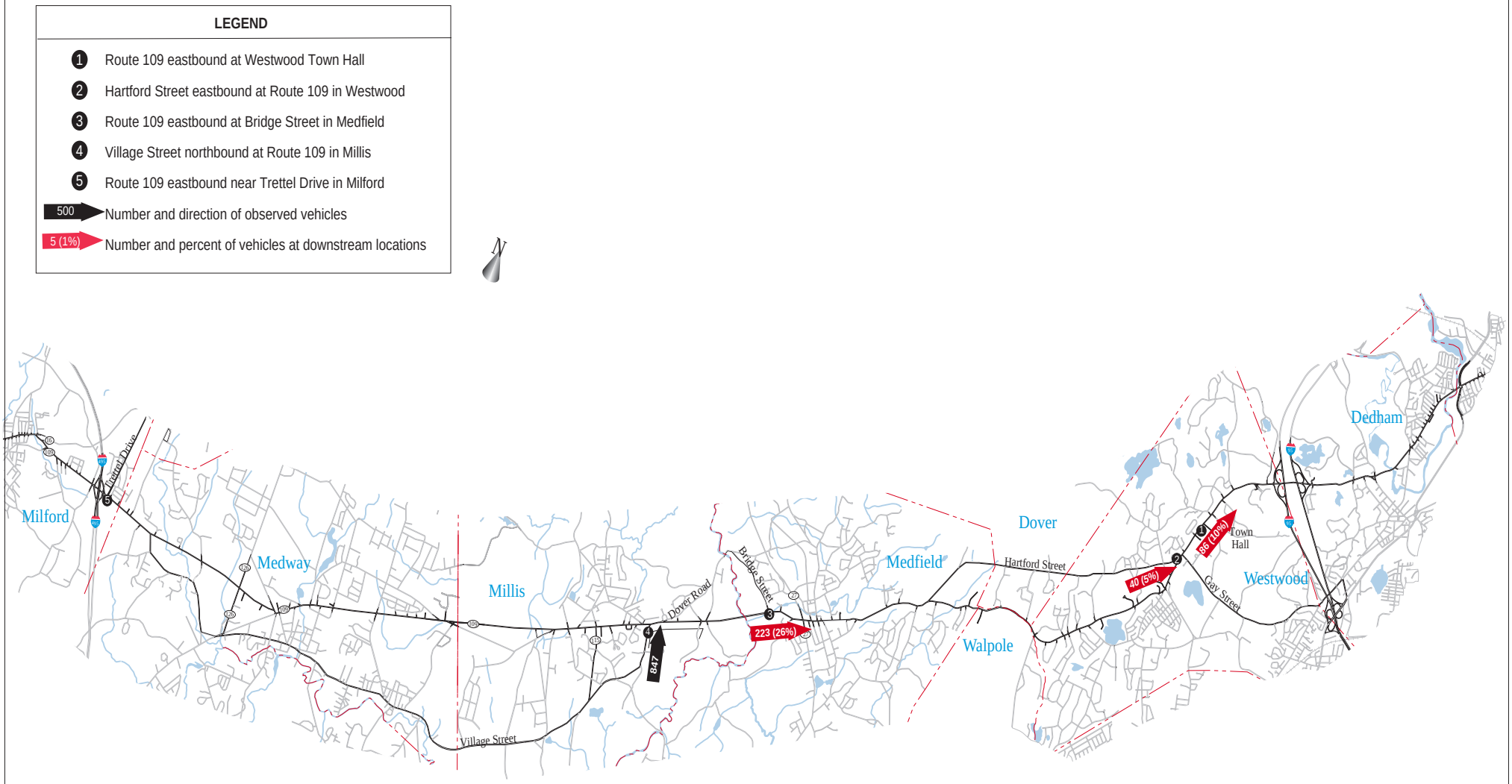
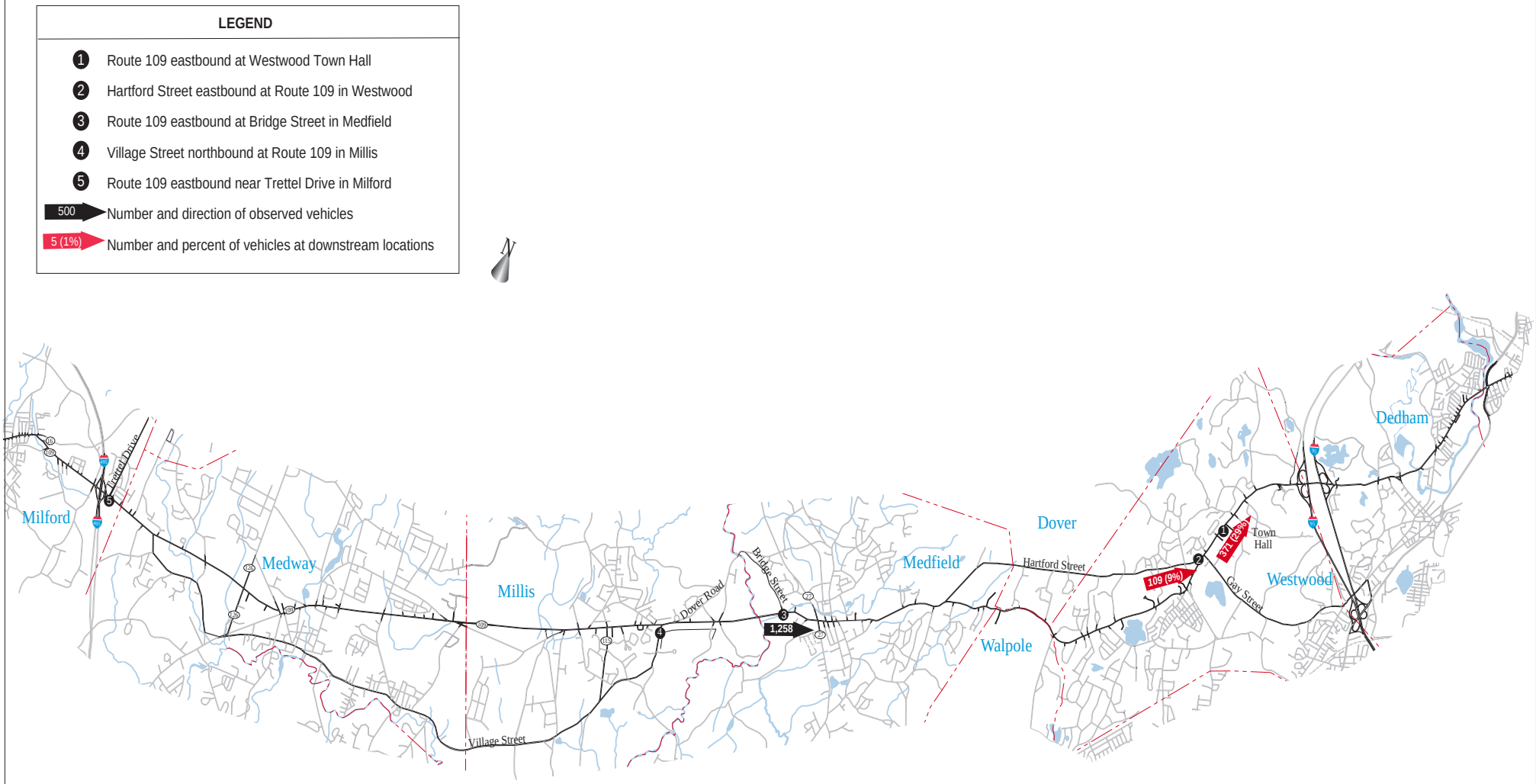
FIGURE 7
License Plate Survey
Distribution of Eastbound Vehicles Observed at Location 5
AM Peak Period, April 9, 2002



Route 109 Corridor Planning Study
CTPS

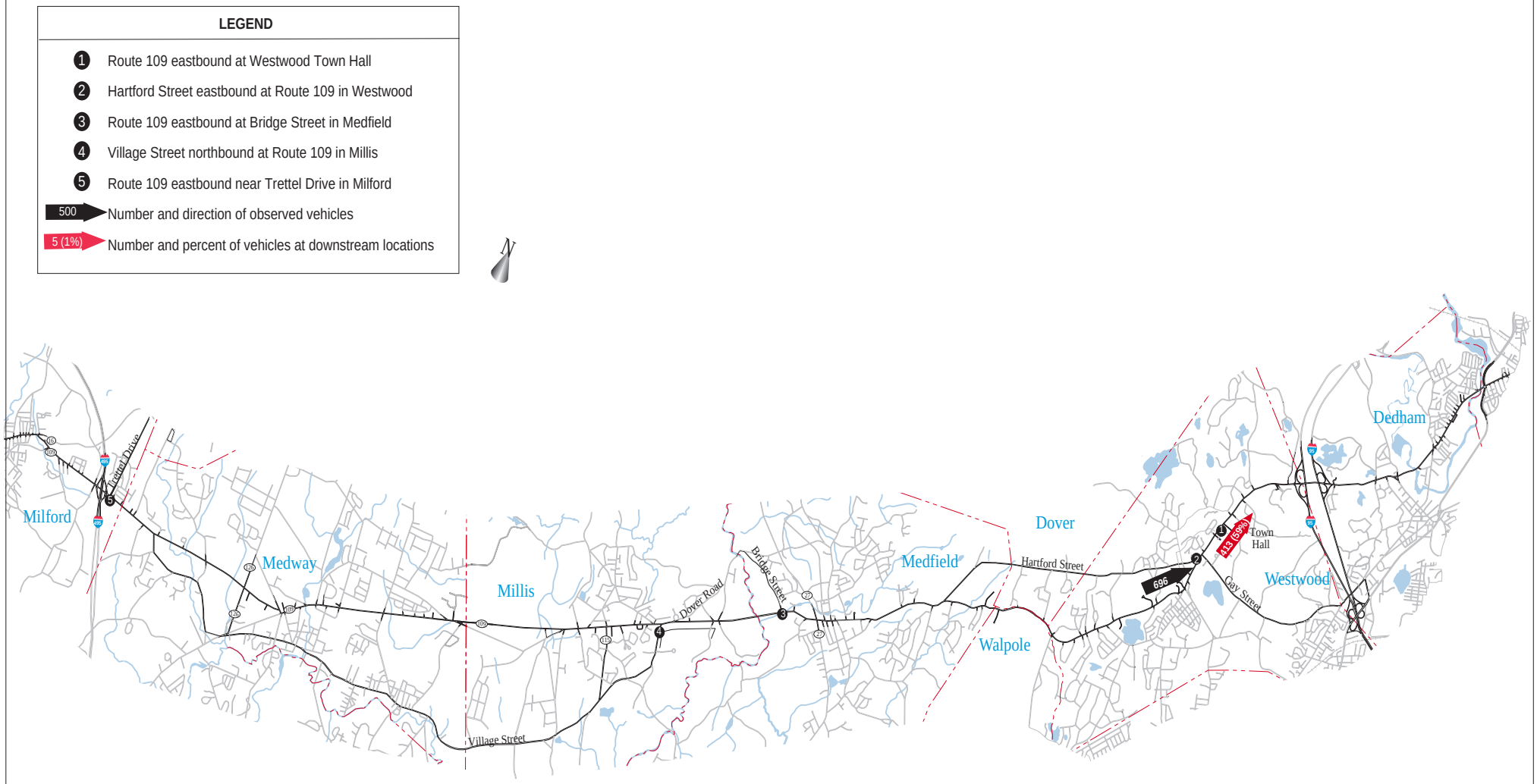
FIGURE 8
License Plate Survey
Distribution of Eastbound Vehicles Observed at Location 4
AM Peak Period, April 9, 2002



Route 109 Corridor Planning Study

CTPS

FIGURE 9
License Plate Survey
Distribution of Eastbound Vehicles Observed at Location 3
AM Peak Period, April 9, 2002



Route 109 Corridor Planning Study
CTPS

FIGURE 10
License Plate Survey
Distribution of Eastbound Vehicles Observed at Location 2
AM Peak Period, April 9, 2002

Less than a third (29%) of the vehicles observed on Route 109 at Bridge Street in Medfield (location 3) were observed again at location 1 (Westwood Town Hall). This is another indication that many of the motorists on Route 109 use only a portion of the corridor to gain access to other roadways to continue their trips.

Approximately 40% of the vehicles observed on Hartford Street at location 2 disappear before reaching the Westwood Town Hall. Gay Street is a plausible exit point, as it provides access to Routes 1 and 1A.

4.2 Vehicle Destinations at Selected Route 109 Segments

Several locations were selected for analysis to identify the likely destinations of Route 109 traffic. A traffic assignment of the CTPS regional traffic model was run for each of the four selected links representing the locations bulleted below.

Table 11 shows, for each of these locations, the top five destinations of the vehicles that pass during the morning peak period. These values should be used with caution, as they are derived from model runs that replicate traffic count volumes by assigning traffic based on travel time and roadway capacity constraints. The results are discussed briefly below.

- *Route 109 East of I-495 in Milford*

  Eighty-six percent of the eastbound traffic on Route 109 east of I-495 in Milford has destinations in just five communities, all of which are fairly close together in or near the western end of the corridor. This finding supports the license plate survey where few vehicles observed at the survey location in Milford were also observed at the survey location in Westwood.

- *Route 109 East of Route 115 in Millis*

  Sixty-six percent of eastbound traffic has destinations in 5 communities. Forty-two percent end in communities along the Route 109 corridor. Another 12% end in Norwood. This reinforces the observation from the license plate survey for location 3 in Medfield where only 29% of observed vehicles were observed again near the end of the corridor in Westwood.

- *Route 109 West of Route 128 in Westwood*

  This link has the most diverse destinations for eastbound traffic of all the analyzed links. Only 52% end in the top five communities with almost a quarter ending in Boston.

- *Route 109 East of Route 128 in Dedham*

  Approximately three quarters (74%) of traffic here has destinations in Dedham and Boston.

TABLE 11
AM Peak Period Traffic Destinations, Selected Links

Location	Direction	Top Five Destinations
Route 109 east of I-495, Milford	EB	35% Medway 18% Holliston 13% Millis 13% Franklin 7% Medfield 86% Subtotal
Route 109 east of Route 115, Millis	EB	19% Millis 15% Medfield 12% Norwood 12% Boston 8% Westwood 66% Subtotal
Route 109 west of Route 128, Westwood	EB	24% Boston 9% Dedham 7% Newton 7% Waltham 5% Quincy 52% Subtotal
Route 109 east of Route 128, Dedham	EB	37% Boston 37% Dedham 4% Brookline 3% Cambridge 2% Newton 83% Subtotal

5.0 POTENTIAL IMPROVEMENT PROJECTS

5.1 Traffic Operations and Safety

Two corridor communities, Westwood and Medway, expressed concern with several intersections that are not currently included in improvement projects. These intersections, analyzed in this section, are:

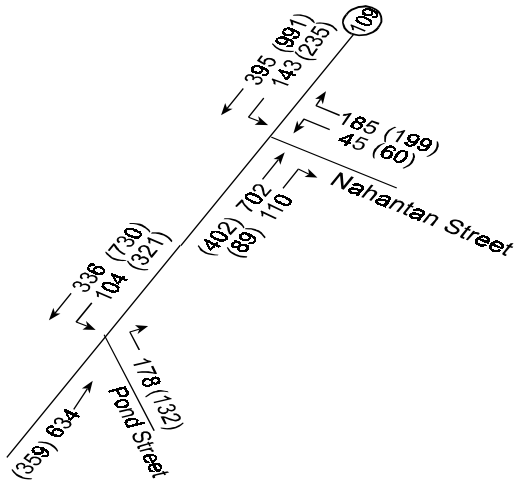
High Street (Route 109) at Nahatan and Pond Streets, Westwood
High Street (Route 109) at North Street ,Westwood
Main Street (Route 109) at Franklin and Milford Streets, Medway

5.1.1 High Street (Route 109) at Nahatan and Pond Streets, Westwood

High Street (Route 109) and Nahatan Street form a three-legged unsignalized intersection. Pond Street forms another three-legged unsignalized intersection with High Street less than 200 feet to the west. A stop sign is located on Nahatan Street. There are two islands at the Nahatan Street intersection to channelize right turns from the eastbound approach, left turns from the westbound approach, and all movements from the northbound approach. The westbound approach has a through lane and a left-turn lane. The eastbound approach at Nahatan Street has two multipurpose lanes. Right turns from High Street to Pond Street and left turns from Pond Street to High Street are not permitted.

Turning movement counts were collected at the intersections from 7:00 to 9:00 AM and 4:00 to 6:00 PM on Tuesday November 27, 2001 (Appendix A). The peak hours for the intersections are 8:00 to 9:00 AM and 5:00 to 6:00 PM. Peak hour counts are presented in (Figure 11).

FIGURE 11
Peak Hour Turning-Movement Counts
High Street at Nahatan and Pond Streets, Westwood



Crash Data Analysis

The Westwood police department provided crash data for these intersections. The data, summarized in Figure 12, covers the three-year period between September 1, 1997 and September 1, 2000. Eighteen crashes occurred at the Nahatan Street intersection and two occurred at the Pond Street intersection during the three-year period averaging six per year and less than one per year, respectively. Two thirds of the accidents at the Nahatan Street intersection occurred on Nahatan Street.

Eight of the crashes at the Nahatan Street intersection were rear-end crashes; six were angle crashes, three were crashes with fixed objects, and one was a sideswipe crash. Only three of the crashes occurred when the pavement was wet or icy. All but one of the crashes occurred during daylight hours. The MassHighway million-entering-vehicles (MEV) crash rate for this intersection is 0.75. This is almost one third higher than the average District 4 unsignalized intersection crash rate which is 0.59.

Both crashes at the Pond Street intersection were rear-end crashes. Both occurred during daylight hours under dry conditions. The MEV crash rate for this intersection is 0.11, which is substantially lower than the District 4 average.

Intersection Capacity Analysis

Table 12 summarizes the analysis results for existing intersection level of service (LOS) and delay for the Nahatan Street intersection. (All approaches at the Pond Street intersection operate at LOS B or better during both peak hours.) Northbound delay on Nahatan Street is approximately 40 seconds during the AM and more than three minutes in the PM. The westbound approach operates at LOS E during the AM and LOS F during the PM.

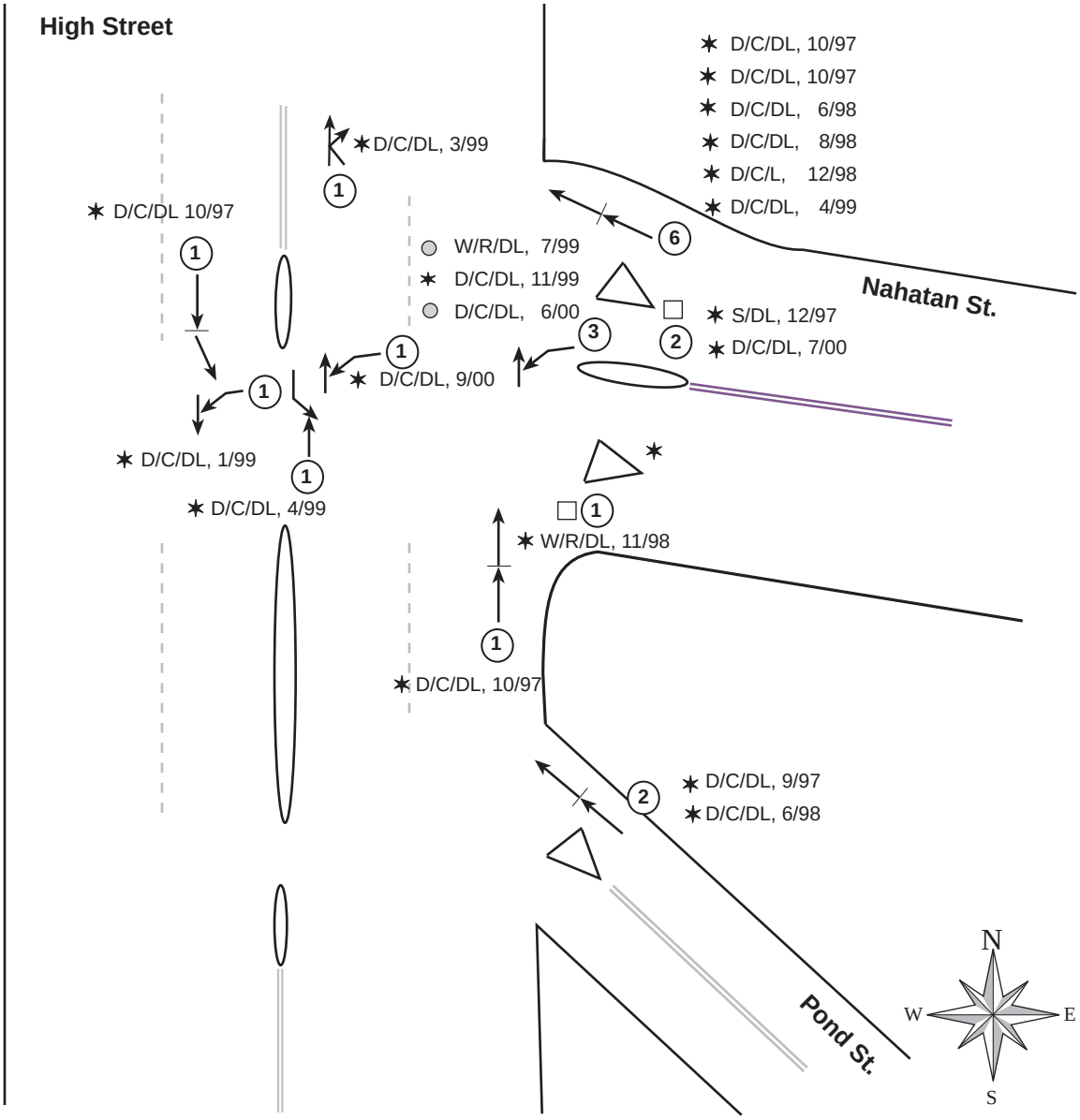
TABLE 12
High Street (Route 109) at Nahatan Street, Westwood
Unsignalized Intersection Capacity Analysis: Existing Conditions

	AM Peak Hour		PM Peak Hour	
Movement	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
Westbound Left Turns	B	11.1	A	--
Northbound Approach	F	148.7	F	757.8

Traffic Signal Warrant Analysis

Traffic signal warrant analysis was performed for each of the unsignalized intersections. Three of the eight warrants for signalization (four-hour volumes, crashes, and peak-hour volumes) were met at the Nahatan Street intersection. The Pond Street intersection met the peak hour and four-hour volume warrants (Table 13).

Figure 12
Collision Diagram
9/1/97 to 9/1/00
High Street (Route 109) at Nahatan and Pond Streets
Westwood



SYMBOLS		PAVEMENT/WEATHER/LIGHTING		TYPES OF COLLISIONS	
←	Moving Vehicle	D	Dry	→ ←	Head On
←≈	Backing Vehicle	C	Clear	↗ ←	Angle
-- -- --	Pedestrian/Bicycle	W	Wet	← ←	Rear End
▨	Parked Vehicle	R	Rain	← ↙	Sideswipe
✶	Property Damage Only	F	Foggy/Cloudy	↓ ←	Broadside
○	Injury	S	Snowy, Icy		
●	Fatality	O	Other		
□	Fixed Object	DL	Daylight		
↩	Out of Control	N	Dark – No Lights		
(#)	Number of Accidents	L	Dark – Lighted		

CTPS

TABLE 13
High Street (Route 109) at Nahatan and Pond Streets, Westwood
Signal Warrants

Warrants[1]	Status	
	High St. at Nahatan St.	**High St. at Pond St.**
1 Eight-Hour Vehicular Volume	Not Applicable*	Not Applicable*
2 Four-Hour Vehicular Volume	Met	Met
3 Peak-Hour Volume	Met	Met
4 Pedestrian Volume	Not Met	Not Met
5 School Crossing	Not Met	Not Met
6 Coordinated Signal System	Not Met	Not Met
7 Crash Experience	Met	Not Met
8 Roadway Network	Not Met	Not Met

*Eight-hour volumes were not collected at this intersection

[1]MUTCD,Millennium Edition, US Department of Transportation, 2001.

Potential Improvements

Traffic signal analysis suggests that installing traffic signals at the Nahatan and Pond Street intersections (60-second cycle with three phases) would decrease delays and produce a significant improvement in the LOS for the northbound approach without seriously increasing delay on the other approaches (Table 14). The Nahatan and Pond Street intersections should be controlled by a single controller since they are so close together.

TABLE 14
High Street (Route 109) at Nahatan Street, Westwood
Signalized Intersection Capacity Analysis: With Potential Improvements

	AM Peak Hour		PM Peak Hour	
Movement	**LOS**	**Delay (sec.)**	**LOS**	**Delay (sec.)**
Southbound Left Turns	A	--	A	5.6
Westbound Left Turns	A	8.0	A	6.2
Westbound Right Turns	--	--	--	--
Westbound Approach	A	8.0	A	6.2

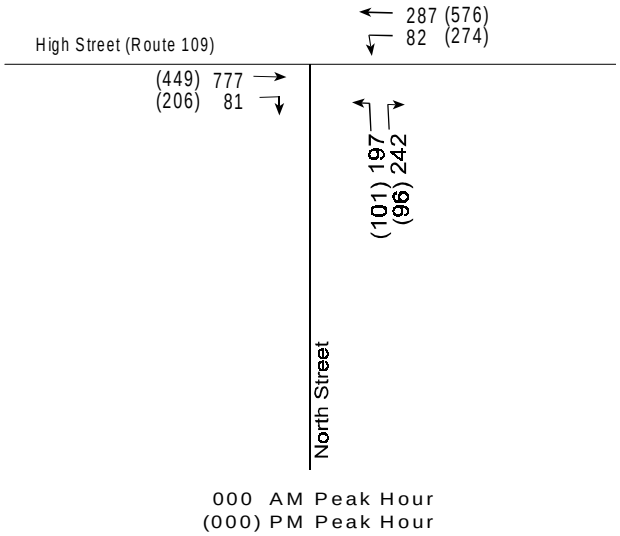
5.1.2 High Street (Route 109) at North Street, Westwood

High and North Streets form a three-legged, unsignalized intersection. The North Street approach is controlled by a stop sign. An island in the southbound lane of North Street

channelizes right turns from High Street eastbound and left turns from High Street westbound.

Turning-movement counts were collected at the intersection between 7:00 and 9:00 AM and 4:00 and 6:00 PM on Wednesday, November 28, 2001. The peak hours for the intersection are 7:00 to 8:00 AM and 5:00 to 6:00 PM (Figure 13).

FIGURE 13
High Street (Route 109) at North Street, Westwood
Peak Hour Turning-Movement Counts



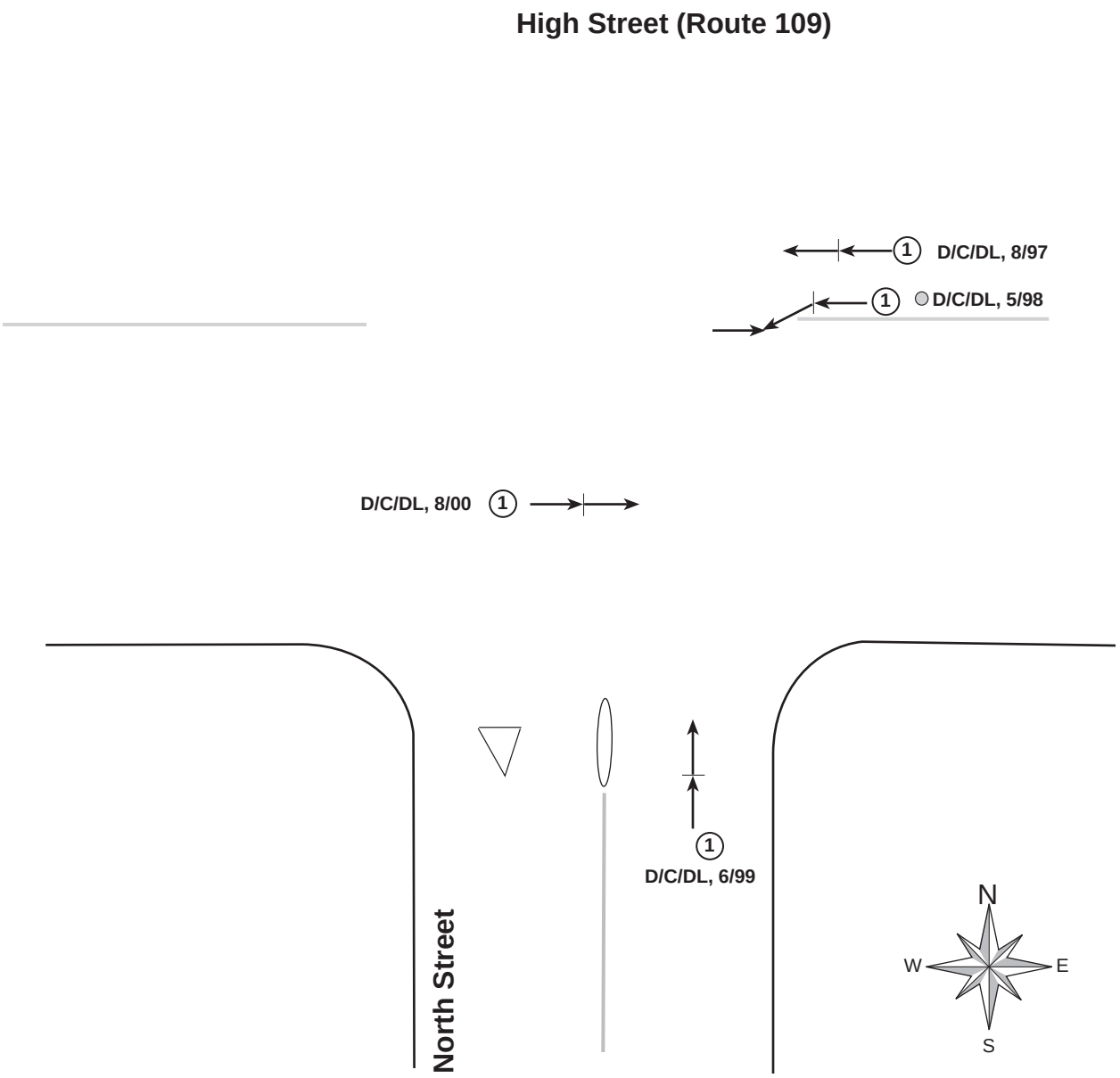
Crash Data Analysis

The Westwood police department provided crash data, summarized in Figure 14, covering the three-year period between September 1, 1997 and September 1, 2000. Four crashes occurred during the three-year period, all were rear-end crashes. One also involved a third vehicle in an angle crash. All occurred on dry pavement during daylight hours. The average number of crashes is 1.33 per year. The MEV crash rate for this intersection is 0.19, well below the District 4 rate of 0.59.

Intersection Capacity Analysis

Table 15 summarizes analysis results for existing LOS for the various movements. The North Street approach operates at LOS F during both peak hours, with over three minutes of delay in the morning and more than one minute of delay during the evening. Both High Street approaches operate at LOS B during both peak hours.

FIGURE 14
Collision Diagram
9/1/97 to 9/1/00
High Street (Route 109) at North Street, Westwood



SYMBOLS		PAVEMENT/WEATHER/LIGHTING		TYPES OF COLLISIONS	
←	Moving Vehicle	D	Dry	→ ←	Head On
←〰	Backing Vehicle	C	Clear	↙ ←	Angle
-- -- --	Pedestrian/Bicycle	W	Wet	← ←	Rear End
▨	Parked Vehicle	R	Rain	↙ ↙	Sideswipe
✶	Property Damage Only	F	Foggy/Cloudy	↓ ←	Broadside
○	Injury	S	Snowy, Icy		
●	Fatality	O	Other		
□	Fixed Object	DL	Daylight		
↖	Out of Control	N	Dark – No Lights		
(#)	Number of Accidents	L	Dark – Lighted		

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TABLE 15
High Street (Route 109) at North Street, Westwood
Unsignalized Intersection Capacity Analysis: Existing Conditions

	AM Peak Hour		PM Peak Hour	
Movement	**LOS**	**Delay (seconds)**	**LOS**	**Delay (seconds)**
Eastbound	--	--	--	--
Westbound Left Turns	B	--	B	--
Northbound Movements	F	198.9	F	81.7

Traffic Signal Warrant Analysis

Traffic signal warrant analysis was performed for the intersection. Two of the eight warrants for signalization (four-hour and peak-hour volumes) were met (Table 16).

TABLE 16
High Street (Route 109) at North Street, Westwood
Signal Warrants

Warrants	**Status**
1 Eight-Hour Vehicular Volume	Not Applicable*
2 Four-Hour Vehicular Volume	Met
3 Peak-Hour Volume	Met
4 Pedestrian Volume	Not Met
5 School Crossing	Not Met
6 Coordinated Signal System	Not Met
7 Crash Experience	Not Met
8 Roadway Network	Not Met

*Eight-hour volumes were not collected at this intersection.

Potential Improvements

Traffic signal analysis suggests that installing a traffic signal at the intersection would decrease delays and produce a significant improvement in the LOS for the northbound approach without seriously increasing delay on the other approaches (Table 17). A signal is recommended at this intersection if additional counts indicate that the eight-hour vehicular volume warrant is met also.

TABLE 17
High Street and North Street, Westwood
Signalized Intersection Capacity Analysis: With Potential Improvements

	AM Peak Hour		PM Peak Hour	
Movement	**LOS**	**Delay (seconds)**	**LOS**	**Delay (seconds)**
Eastbound	C	22.9	C	34.7
Westbound	C	18.1	B	10.1
Northbound	C	32.5	C	32.1
Intersection	C	24.3	C	22.9

5.1.3 Main Street (Route 109) at Milford and Franklin Streets , Medway

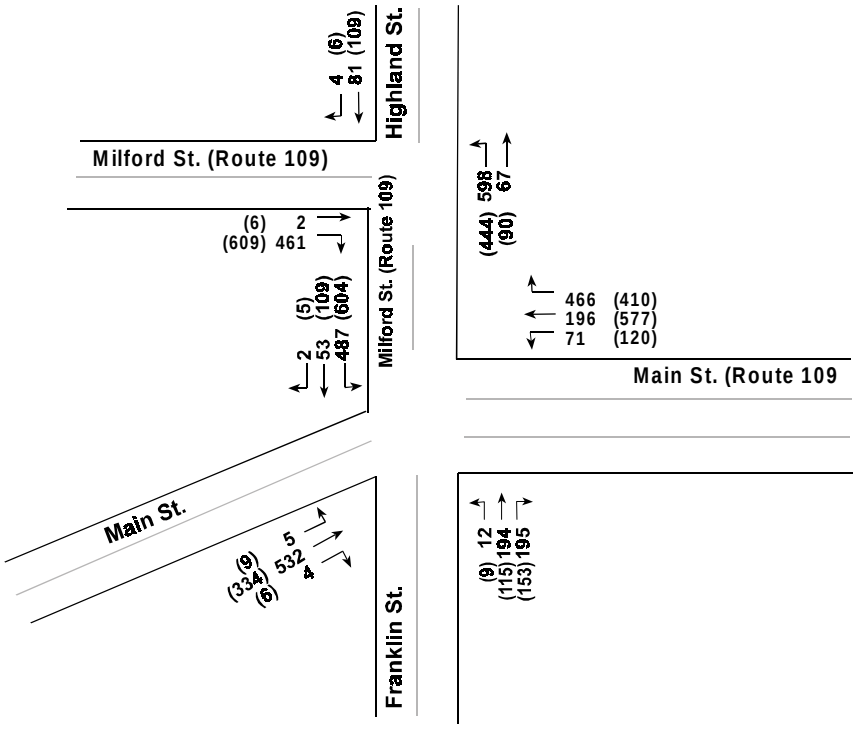
Coming from the west, Route 109 as Milford Street intersects Highland Street in Medway, makes a short jog (less than 200 feet) southbound, intersects Main Street at Franklin Street and continues eastbound as Main Street. There is a flashing yellow light at Milford Street and Highland Street, a stop sign on Highland Street at Milford Street, and a fully actuated signal at the intersection of Milford, Main and Franklin Streets. The westbound approach on Route 109 (Main Street) has one through/left-turn lane and one exclusive right-turn lane. All the other intersection approaches have one lane (Figure 15). The traffic signal equipment is old and can not satisfy current demand. Medway has identified this intersection as one that needs to be improved.

Turning-movement counts were collected at the intersection between 7:00 and 9:00 AM and 4:00 and 6:00 PM on Thursday, January 24, 2002. The peak hours for the intersection are 7:00 to 8:00 AM and 4:45 to5:45 PM (Figure 15).

Intersection Capacity Analysis

Table 18 summarizes the analysis results for existing LOS for the various movements. Overall, the intersection operates at LOS F during both the AM and PM peak hours, with approximately a one-minute delay during the AM peak hour and about one and a half minutes of delay during the PM peak hour. The Milford Street southbound approach has the worst LOS, with almost four minutes of delay during the AM and PM peak hours. The Route 109 geometry is responsible for much of the delay, with eastbound Route 109 traffic queuing up on Milford Street at the signal, where almost 500 vehicles turn left during the AM peak hour and approximately 600 do so during the PM peak hour.

FIGURE 15
Main, Milford, and Franklin Streets, Medway
Turning-Movement Counts



000 AM Peak Hour
(000) PM Peak Hour

TABLE 18
Main Street at Milford Street (Route 109) and Franklin Street, Medway
Signalized Intersection Capacity Analysis: Existing Conditions

	AM Peak Hour		PM Peak Hour	
Movement	LOS	Delay (seconds)	LOS	Delay (seconds)
Main St. Eastbound	B	16.6	B	15.4
Main St. Westbound	A	6.2	D	47.5
Franklin St. Northbound	B	15.2	B	13.7
Milford St. Southbound	F	226.8	F	233.7
Intersection	F	64.6	F	93.6

Potential Improvements

Various signal timing, phasing, and geometric changes were tested in Synchro[4] for the PM peak hour when the total intersection volume is higher than in the AM peak hour. They include

Scenario 1

Adding a leading left to the signal phase on the Main Street westbound approach and changing the cycle length to 65 seconds. This requires no geometric changes (see "Existing Geometry" in Figure 16,)).

Scenario 2

Redesignating the Main Street westbound right-turn lane as a through/right-turn lane and adding a left-turn lane on Milford Street southbound. This requires some widening on Milford Street (Figure 16).

Scenario 3

Adding a left-turn lane on Milford Street southbound with a 90-second cycle length and a leading southbound left-turn phase. Requires minor widening for a departure lane on Main Street and some widening on Milford Street (Figure 16).

Scenario 4

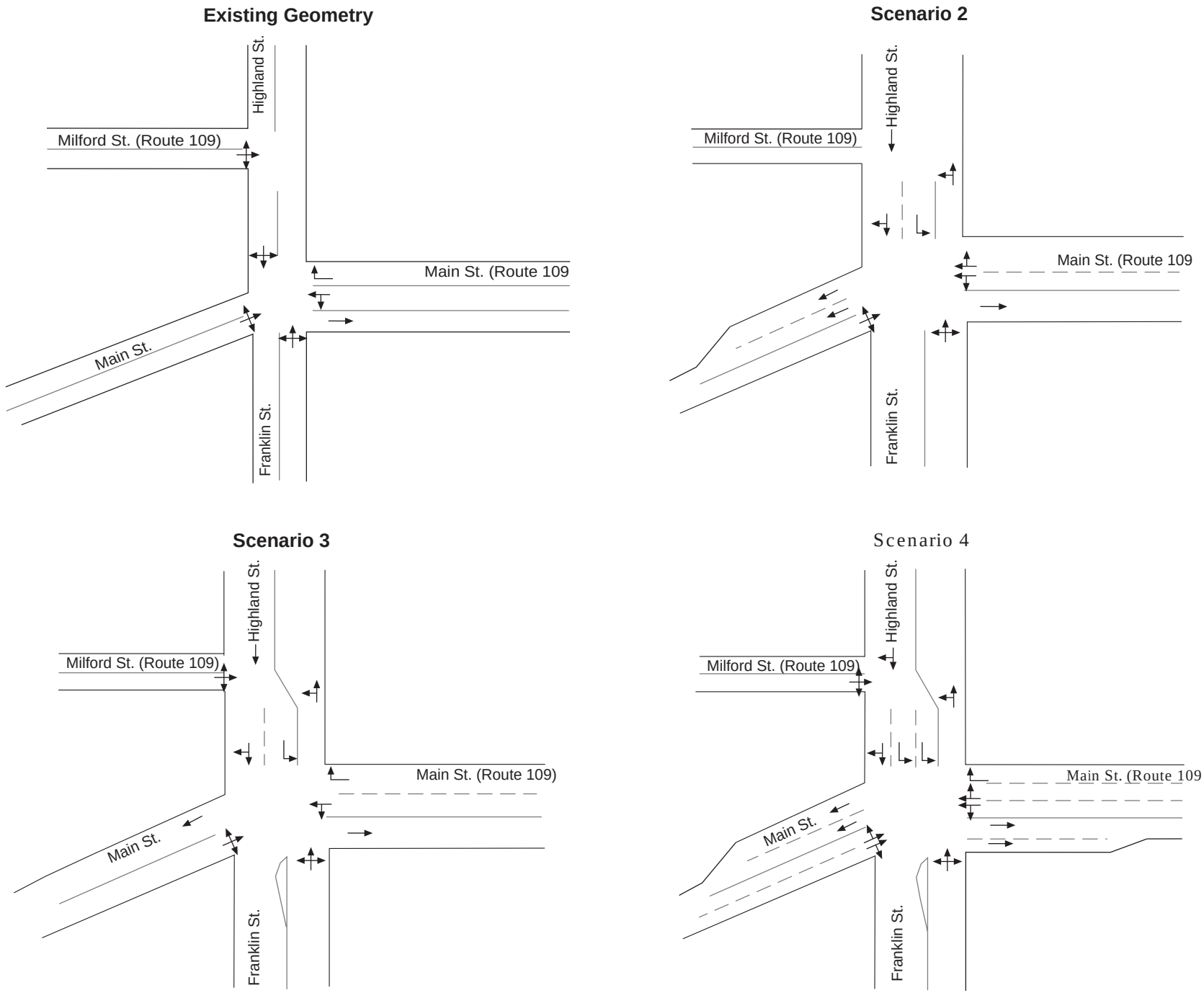
Adding two southbound left-turn lanes on Milford Street, a second through/left-turn lane on Main Street westbound, and a second through/left-turn lane on Main Street eastbound with a 120-second cycle length. Requires widening on Milford and Main Streets (Figure 16).

Route 109 does not fall under state jurisdiction; however, state guidelines must be followed if federal funds are used for a project. MassHighway lists desirable and maximum design standards in its Highway Design Manual.[5] This manual states:

> Use of less than desirable values should be justified within the Functional Design Report. Although minimum standards are acceptable, when the minimum standards can not be achieved, documentation and approval of these Design Exceptions are required. Use of less than minimum standards must be based on sound engineering judgement weighing relevant factors…Safety and traffic operations must not be reduced on the facility as a result of using lower standards. For resurfacing, rehabilitation, and minor reconstruction projects, the values in Table 8.1 may be substituted for the values in Table 5.1. Reasons for not using the Table 5.1 values should be documented in a design exception request, however, use of the lower values will generally require minimal justification.[6]

Table 19 incorporates the MassHighway Design Manual's Table 8.1 and Table 5.1 values for arterials.

[4] Synchro, Traffic Signal Timing Software,Trafficware, CA., 2000.
[5] The Commonwealth of Massachusetts Highway Design Manual, MassHighway, Metric Edition, 1997.
[6] Ibid. p 8.02.0.



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Route 109 Corridor Planning Study

Figure 16
Main, Milford, and Franklin Streets, Medway
Existing Geometry and Potential Improvements

Table 19
Recommended Roadway Section Widths in Meters

	Table 5.1		Table 8.1 (Substitution Widths)	
	Desirable	**Minimum**	**Desirable**	**Minimum**
Travel Lanes	3.75 (12 ft.)	3.5 (11 ft.)	3.6 (11.6 ft.)	3.3 (10.6 ft.)
Usable Shoulders[1]	3.00 (10 ft)	2.5 (8 ft.)	3.0 (10 ft.)	2.4 (8 ft.)

[1]The offset dimension (0.5-M minimum) is to be added to the usable shoulder dimension to allow for vertical elements over 200 MM high at the edge of the graded shoulder.

Using MassHighway's minimum substitution lane widths (10.6 feet) and suggested sidewalk widths (6 feet), (footage for shoulders, where needed, would have to be added to the measurements):

Scenario 2 requires a 44-foot right-of way on Milford Street, a 44-foot right-of-way on the Main Street westbound approach and a 44-foot right-of-way on the Main Street eastbound approach.

Scenario 3 requires a 44 foot right-of way on Milford Street and a 44 foot right-of-way on the Main Street westbound approach.

Scenario 4 requires a 54.4-foot right-of way on Milford Street, a 65-foot right-of-way on the Main Street westbound approach, and a 54.4-foot right-of-way on the Main Street eastbound approach.

Measurements taken from the signal permit indicate that there is at least 60 feet of right-of-way on all but the Franklin Street approach. This suggests that only scenario 4 would require acquiring additional right-of-way.

The cycle length, maximum volume/capacity (V/C) ratio, intersection signal delay, intersection capacity utilization, and LOS, and queue length that would result from implementing each of the scenarios are presented in Table 20. The following are some of the more important findings:

Scenario 1
Phasing and timing changes increase the maximum V/C ratio and slightly reduce the southbound queue.

Scenario 2
Redesignating lanes on Main Street westbound and adding a left-turn lane on Milford Street reduce the V/C ratio (still over capacity), reduce delay and capacity utilization, and improve the LOS.

Scenario 3
Adding a southbound left-turn lane without changing lane designations on Main Street increases the maximum V/C ratio and queues.

Scenario 4
Adding two southbound left-turn lanes on Milford Street, a second through/left-turn lane on Main Street westbound, and a second through/left-turn lane on Main Street eastbound improves the V/C ratio, delay, capacity utilization, LOS, and queues.

TABLE 20
Main Street (Route 109) at Milford and Franklin Streets, Medway
Intersection Capacity Analysis: With Potential Improvements

	Existing Conditions	Scenario 1 Phasing and Timing Changes[1]	Scenario 2 WB Lane Redesignation	Scenario 3 Southbound Left-Turn Lane	Scenario 4 Multiple Geometric Changes
Cycle Length	70 Sec.	65 Sec	110 Sec.	90 Sec.	120 Sec.
Maximum V/C Ratio	1.77	1.90	1.10	1.97	0.96
Intersection Signal Delay	93.6 Sec.	107.2 Sec.	62.9 Sec.	89.5 Sec.	31.3 Sec.
Intersection Capacity Utilization	133.8%	133.8%	122.5%	127.3%	85.8%
Intersection LOS	F	F	E	F	C
Queue Length 50th (ft.)					
Main St. Eastbound	118	112	192	141	80
Main St. Westbound Thru	375[2]	388[2]	383[2]	433	190
Franklin St. Northbound	84	65	181	130	198
Milford St. Southbound	523[2]	497[2]			
Left-Turns			477[2]	585[2]	261
Through Movement			44	40	58

[1]Queues are shorter than Existing Conditions
[2]Volume exceeds capacity. Queue is theoretically infinite

5.1.4 Implementation Process for Intersection Improvements

If communities wish to implement intersection improvements, signal upgrades, or signal installation, they may request the Massachusetts Highway Department's assistance in obtaining funding and other implementation aspects. Assuming that none of the improvements requires environmental impact assessments, the process is as follows:

1. The town must make a written request for assistance to the appropriate Massachusetts Highway Department district director. The letter should explain why improvements are needed, describe the proposed improvements, and indicate the level of local support for the project. The letter should cite any studies that have documented the value of the project. A copy of the letter should be sent to the chair of the Boston Metropolitan Planning Organizations' Transportation Planning and Programming Committee.

2. The district office will review the request and possibly request a Project Justification Report. It is the responsibility of the town to prepare the report, if requested, and submit it the district office.

3. At this point, the town should meet with the district office to discuss the proposed project and plan the remaining steps required to complete the process, possibly including holding an informational meeting to determine the degree of community support or opposition.

4. If the evaluation of the Project Justification Report is favorable and there is local support for the project, the district office will submit a favorable request to the Project Review Committee (PRC) of MassHighway. The PRC will then determine whether the proposed project is eligible for federal and state highway funding, and MassHighway will notify the town of the results.

5. If the proposed project is approved, the town should request that the Boston Metropolitan Planning Organization place the project in the region's Transportation Improvement Program (TIP). The project must have regional benefits and comply with the regional Transportation Plan.

6. Once the project is in the TIP, the town should prepare the necessary construction documents for submittal to MassHighway. Depending on the complexity of the project, submittals might be required at the 25%, 75%, or 100% design phase. When project priorities and funding availability allow, MassHighway will advertise and award the project, and issue a notice to proceed with construction.

Projects can use funds from a variety of funding categories. It should be noted that there is competition among many projects for the available funds; the priority of each project determines whether it is assigned to a funding category and programmed in the TIP. The funding categories for which projects are eligible are:

Non-Federal Aid (NFA) which funds construction, reconstruction, and improvement projects on roads and bridges in urban and rural areas.

Surface Transportation Program (STP) which funds projects chosen by states and localities on any roads that are not functionally classified as local or rural minor collectors.

STP Earmark (STP O) which is a portion of the STP funding earmarked for urban areas with a population over 200,000.

5.2 Alternative Transit Services

Corridor communities have expressed interest in shuttle bus service to increase local mobility. This service could be demand-responsive or regular fixed route. This section discusses the initial service requirements, the experiences of other Massachusetts communities with these services, and potential ridership and operating costs.

5.2.1 Demand-Responsive Transit Service

A demand responsive service is one in which a customer has to make a reservation and is

provided with door-to-door service. Some operations provide services for a specific trip type, while others provide service for all types of trips. As mentioned previously, THE RIDE is available in all corridor communities except Millis, Medway, and Milford. In addition, each corridor community's Council on Aging provides transportation services (mostly in passenger vans). Only medical trips are served in Dover, Milford, and Westwood. The other five Councils on Aging serve social and shopping trips as well. Several also have specific days on which trips are made to shopping malls. Most do not cover medical trips to Boston. Both THE RIDE and the Councils on Aging require advance reservations. The majority of people who use these services are either elderly, have a disability, or both.

Individual corridor communities or a consortium of communities could create a demand-responsive service to offer citizens of all ages more trip-making flexibility. With this type of service, trip requests could be made during a specific time period or at any time of day when vehicles are on the road. For example, the town of Bedford operates a demand-responsive service Monday through Friday from 9:00 AM to 11:55 AM and from 1:00 PM to 2:55 PM. Calls for service must be placed between 8:00 and 9:00 AM. In addition, there are two scheduled daily trips to the Burlington Mall. The Mall trips are at noon and 3:00 PM, stopping at two supermarkets along the way. People who go out on the noon trip return on the 3:00 PM trip.[7] The town operates the service with a fully accessible 11-passenger van, one primary driver, and one back-up driver.

5.2.2 Fixed-Route Bus Service

There is no publicly operated fixed-route bus service in the Route 109 corridor. The Brush Hill Transportation Company operates in the corridor on a route that runs from Milford to Westwood into Boston, with one inbound and one outbound trip.

Fixed-route service can operate during peak commuter periods or throughout the day. A peak-period-only service primarily benefits commuters. It can be in the form of:

- Service from a remote lot to commuter rail stations with parking lots that fill early in the morning
- Service from commuter rail stations to corridor employment sites to serve reverse commuters
- Service from corridor communities to employment centers outside the corridor.

A remote-lot service assumes commuters who would use the shuttle would drive to an off-site parking lot and transfer to a bus that would take them to the station. CTPS has not found any examples of such a service being operated successfully either in the MBTA service area or in a comparable metropolitan area. Drivers unable to park at the nearest

[7] Central Transportation Planning Staff, *MAGIC Subregional Area Study, Phase I Report: Current Conditions and Proposed Additional Studies*, February 14, 2002, Appendix C.

rail station would more likely drive to another station or drive for the entire trip than use a remote parking facility.[8]

Shuttle service for reverse commuters requires concentrated work sites, adequate train schedules, and enough commuters who make the reverse commute and do not have access to personal vehicles. Train schedules are one of the major obstacles to implementing this type of service within the corridor. Currently, two trains leave Boston on the Franklin Line during the morning peak period. The 7:05 AM train goes no further than Walpole. The 7:50 AM train stops at all the stations but arrives at the Walpole station at 8:24 AM and at the end of the line at Forge Park at 8:45 AM. There are two return trips. The first trip leaves Forge Park at 4:01 PM; the second leaves at 5:27 PM. Both trains make all stops. The 7:50 AM trip and the 5:27 PM trip might work for those who work from 9:00 to 5:00, but any delay in connections would cause some commuters to be late for work or to miss the train home.

The town of Lexington is an example of a community that operates fixed-route service. Lexington began its Lexpress service in 1980 and currently operates six routes with hourly headways over an 11-hour day (roughly 7:00 AM to 6:00 PM).

Service from corridor communities to employment centers outside the corridor is discussed in section 5.3.

5.2.3 Ridership

It is difficult to estimate demand for local services. Standard travel-forecasting methods are not very accurate techniques for estimating demand for intra- or inter-suburban, non-commuter trips. However, one can obtain a reasonable idea of the demand for such services by examining previous experience and by comparing the proposed service with similar services in similar communities. A recent CTPS memorandum documented experience in Bedford and Lexington, which can be used for comparison purposes, as these towns have socioeconomic characteristics similar to those of many corridor communities (Table 21).[9]

Bedford's demand-responsive service averaged between 25 and 30 passengers per day between 1988 and 1992. Counts in November 2000 indicated ridership of about 26 passengers per day, using one vehicle.[10] A similar count in September 2001 revealed approximately the same ridership. The total operating cost for February 2002 was $2,460. Revenue for the month was approximately $153.[11]

Ridership on Lexington's fixed-route service, Lexpress, averaged 452 passengers per day in 1992 and 432 per day in November 2000. The latter equals an average of about 70

[8] Central Transportation Planning Staff, "Feasibility of Adding Westborough Stops to Southborough Commuter Rail Shuttle Service, Including Time Comparisons with Other Alternatives,", April 2002.
[9] Op. Cit. McShane, et al
[10] Ibid. McShane, et al, Appendix C, pg. 4
[11] Ibid

riders per day on each route.

> The existing Bedford and Lexington services represent the range one might expect in ridership for a new service assuming 1 vehicle operating a sequence of loops around a community throughout the day-between 25 and 70 passengers per day, with 45-50 as the most likely average ridership. The actual ridership depends entirely on the specifics of the route or routes, the frequency of service, and the markets served: loops which serve neighborhoods or markets of relatively low auto availability and high transit dependence will attract more riders than neighborhoods or markets where auto availability is almost universal. Multiple routes that operate on short headways will generally attract more patrons than a single, long looping trip with less frequent stops at any one location; but such services would require additional vehicles, increasing the cost. Ridership would be limited by the number of residents or businesses within easy walking distance of any route. This is the principal limitation of suburban services".[12]

TABLE 21
Comparison of Socioeconomic Characteristics

Town	Population	Age						Pop/Sq. Mile	Median HH Inc.	Autos/ HH
		10-14	%	15-19	%	65+	%			
Dedham	23,464	1,167	5.0%	1,228	5.2%	3,905	16.6%	2,235	$61,699	1.73
Dover	5,558	511	9.2%	343	6.2%	624	11.2%	363	141,818	2.18
Medfield	12,273	1,226	10.0%	760	6.2%	1,137	9.3%	846	97,748	2.00
Medway	12,448	1,119	9.0%	718	5.8%	1,137	9.1%	1,082	75,135	1.96
Milford	26,799	1,827	6.8%	1,521	5.7%	3,448	12.9%	1,836	50,856	1.68
Millis	7,902	540	6.8%	407	5.2%	743	9.4%	648	62,806	1.87
Walpole	22,824	1,702	7.5%	1,279	5.6%	3,293	14.4%	1,113	74,757	1.87
Westwood	14,117	1,104	7.8%	705	5.0%	2,701	19.1%	1,283	87,394	1.84
Bedford	12,595	809	6.4%	610	4.8%	2,311	18.3%	919	87,962	1.85
Lexington	30,355	2,491	8.2%	1,773	5.8%	5,767	19.0%	1,851	96,825	1.82

Source: 2000 Census

5.2.4 Revenue and Service Costs

Revenue depends on fares charged. Lexpress in Lexington has base fares of $1.00 for adults and students, 50 cents for seniors, and 25 cents for transfers. The Bedford service charges a low fares: for in-town service, 50 cents for adults and students and 25 cents for seniors; for trips out of town to the mall, 75 cents for adults and students and 35 cents for seniors. The Bedford service is subsidy-dependent.

Operating costs depend on the type of service and vehicle used. Typical per-day, per-vehicle costs for operating shuttle buses, based on bids by service providers for a recently contracted service, are: minimum bid, $320 per day, per vehicle; maximum bid, $637 per day, per vehicle.

[12] Central Transportation Planning Staff, *MAGIC Subregional Area Study*.

These estimates are for six-hour, peak-period-only service (6:30 to 9:30 AM and 3:30 to 6:30 PM), which is associated with the lower ridership estimates discussed above, and which in most cases does not meet the needs of a non-commuting clientele. If full-day service is desired, these estimates should probably be doubled. Note also that these estimates assume minibus-type vehicles. If standard-size buses were used instead of minibuses contracted by the town through service providers, the estimates would be higher.

The likely range of annual operating cost (using the lower cost estimate and doubling it for full-day service where applicable) exclusive of the salary for an administrator/dispatcher, would be approximately $45,000 to $67,500 per vehicle for peak-period service and $125,000 to $147,500 per vehicle for full-day service (Table 22). The value of the subsidy provided per rider would be approximately $2.50 to $12.50 per round trip.

TABLE 22
Estimated Revenue and Service Costs[1]

	Peak-Period Service		Full-Day Service	
	Max. Fare, Max. Ridership	**Min. Fare, Avg. Ridership**	**Max Fare, Max Ridership**	**Min. Fare, Avg. Ridership**
Daily Service Cost/Vehicle	$320	$320	$640	$640
Daily Revenue	$140	$ 50	$140	$ 50
Daily Subsidy Required/Vehicle	$180	$270	$500	$590
Estimated Annual Cost[2]	$45,000 per vehicle	$67,500 per vehicle	$125,000 per vehicle	$147,500 per vehicle

[1]Does not include the cost of an administrator/dispatcher

[2]Weekdays only (250 days/year)

5.2.5 Potential Funding Sources

In all likelihood, the primary support for these types of service would be town-generated funding. The MBTA subsidizes the Bedford service through the Suburban Transportation Program. This program, however, has not expanded in recent years and is now level-funded. Support might be sought through a number of other sources, including:

1. The Transportation Demand Management program funded through the federal Congestion Mitigation and Air Quality Improvement Program (CMAQ), with additional state highway funds, and administered through MassHighway Planning.

2. The Executive Office of Elder Affairs formula grant program that makes funding available to local Councils on Aging.

3. Contributions from private industry or private developers.

5.2.6 Developing a Town-Based Administrative Structure

The operation costs previously discussed do not include administrative costs. The operation of this type of service typically requires at least a part-time coordinator to handle day-to-day operational issues and to deal with the contracted service provider. In addition, many services have a town-based advisory committee empowered to:

- Develop and oversee an annual budget.
- Negotiate contracts.
- Hire and fire employees.
- Evaluate and recommend potential service changes.
- Report to the Town Meeting or other responsible town officials on the operation, patronage, and finances of the system.

5.3 Park-and-Ride Lots

Several corridor communities have expressed interest in establishing a park-and-ride lot at one or more locations along Route 109. There is little recent data on average carpool trip lengths. However, informal observations suggest that commuters do not carpool for shorter trips, as the transfer penalty (the time required to go from one's vehicle to the vehicle in which the trip is completed) represents a larger proportion of total trip time than it does for longer trips. RIDES in the San Francisco Bay Area surveys commuters periodically. It recently determined that the average one-way commuter trip is 17 miles but the average carpool commuter trip is 22 miles.[13] This lends some support to the anecdotal observations.

The license-plate survey and a CTPS traffic model assignment indicate that vehicles do not travel great distances along the Route 109 corridor. As previously mentioned 86% of the vehicles traveling eastbound on Route 109 just east of I-495 during the morning peak period have destinations in 5 communities all of which are fairly close together in or near the western end of the corridor. (Two-thirds of these vehicles originated within 20 miles of this location).

On Route 109 eastbound in Millis east of Route 115, over half (55%) of morning peak period traffic has destinations in Millis, Medfield, Norwood, and Westwood (all originated within 20 miles of this location).

One way to provide local park-and-ride lots and to test demand without major infrastructure investment is to contract with an entity, e.g. a supermarket or a church, that

[13] Commuter Profile 2001, Survey of San Francisco Bay Area Commuters, RIDES, September 2001.

has unused capacity in an existing parking lot. While considering establishing a lot, one should note that a statistical analysis conducted by CTPS[14] indicates that bus service from a lot is an important requirement for a successful lot.

Transit service from a park-and-ride lot to employment centers outside the corridor requires fairly concentrated destinations. An analysis of the CTPS traffic model data for the segment of Route 109 in Westwood west of I-95/Route 128 revealed the following information about destinations during the AM peak period (this location was chosen because it has the highest traffic volumes):

- 28% have destinations in Boston or Cambridge.
- 10% have destinations in Braintree, Quincy or Weymouth.
- 14% have destinations in Newton or Waltham.

Applying these proportions and an average auto occupancy rate of 1.15 to the vehicles observed at the survey location in front of the Westwood Town Hall results in

- 752 commuters with destinations in Boston and Cambridge
- 269 commuters with destinations in Braintree, Quincy, and Weymouth
- 430 commuters with destinations in Newton and Waltham.

According to the 2000 Census, 4.5 % of commuters travel by bus in the MAPC region, 2.9% travel by bus in the state as a whole, and 0.53% do so in Danvers. (Danvers is cited here because it is located near Route 128, has nearby train service, and has limited bus service, as do Westwood and several other corridor communities.) If these proportions were used to estimate high, medium, and low demand for a bus service from a park-and-ride lot, the results listed in Table 23 would be obtained for the Westwood location. These theoretical estimates would be influenced by service frequency, number of stops, employment densities, and ease of access to destinations at the end of the trip. In addition, a suitable site for a park-and-ride lot would have to be found.

TABLE 23
Estimated Demand for Commuter Bus Service, Westwood

Destination	Total Commuters	High Demand (4.5%)	Medium Demand (2.9%)	Low Demand (0.53%)
Boston/Cambridge	752	34	22	4
Braintree, Quincy/Weymouth	269	12	8	1
Newton/Needham/Waltham	430	19	12	2
Total	1,451	65	42	7

[14] Central Transportation Planning Staff, "Estimating Demand for MassHighway Park-and-Ride Lots," July 28, 1999.

5.4 Bicycle and Pedestrian Accommodations

Adequate roadways, sidewalks, and shoulders are critical for pedestrian and bicycle safety. There are no specific bicycle accommodations in the corridor at the present time. This section discusses how bicycles can be accommodated and the status of sidewalks and shoulders in the corridor.

5.4.1 Bicycle Accommodations

Bicyclists can be accommodated in bicycle lanes, by sharing roadways, and by sharing sidewalks. Bicycle lanes are portions of the roadway cross-section that have been designated for the exclusive use or preferential use of bicyclists. Signs and pavement markings designate the lanes. Shared roadways are highways where a bicycle lane is not designated, but bicycles are legally allowed to use the road. Bicyclists and pedestrians may be allowed to use the same sidewalks in some locations. The first consideration, however, should be to safely accommodate bicyclists in the roadway. MassHighway has designated minimum and or desirable widths for all three accommodations (Appendix B).

5.4.2 Sidewalks

With the exception of Dover and Walpole, sidewalks are available on one or both sides of Route 109 for various segment lengths in each of the corridor communities, as described below. The information is taken from MassHighway Roadway Inventory File.

Dedham

There are four-foot sidewalks between the Boston city line and Ames Street and five-foot sidewalks between High and Lowder Streets. There are no sidewalks between Lowder Street and the Westwood town line. Some existing crosswalks need to be restriped.

Westwood

With the exception of the segment between Stanford Drive and the Walpole town line, there are four- to six-foot sidewalks on at least one side of Route 109. Many of the crosswalks need to be restriped.

Medfield

There are sidewalks on approximately a quarter of Route 109 in Medfield. There are five- to seven-foot sidewalks on both sides of the roadway between Robert Sproul Road and Causeway Street and on one side of the roadway between Causeway Street and the Millis town line. The roadway was repaved and the crosswalks were restriped recently.

Millis

There are four-foot sidewalks along approximately two-thirds of Route 109 in Millis. Much of the roadway has been reconstructed recently or is under construction. Therefore, these characteristics might have changed or may do so in the near future.

Medway

There are four-foot sidewalks on at least one side of Route 109 between Carol Lane near the Millis town line and the intersection with Franklin and Highland Streets. Crosswalks are fading and should be restriped.

5.4.3 Roadway Shoulders

According to the Roadway Inventory File, there are two-foot shoulders throughout most of the length of the roadway. In many areas, utility poles are close to the shoulders. These conditions are not particularly attractive or safe for bicyclists or for pedestrians in areas that do not have sidewalks.

6.0 SUMMARY AND CONCLUSIONS

6.1 Summary

Corridor residents want to maintain the character of the region. While they have expressed interest in multimodal measures to promote safety, efficiency of traffic movement, and local circulation, they have also expressed the desire to avoid measures that would involve significant additions to existing roadway capacity, associated land-takings, and environmental impacts. This study looked at strategies that appear to meet all of the basic criteria of corridor residents and officials.

Average daily traffic (ADT) at most MassHighway count locations on Route 109 has remained fairly constant during the past decade. The exceptions are in Milford at the Medway town line where, ADT has increased gradually, in Medfield east of Brook Street, where ADT increased by 87% between 1988 and 1997 but has since decreased.

The eastbound direction is dominant in the AM peak hour. The volume increases substantially in Westwood and then decreases by two-thirds (68%) after many vehicles exit to Route 128. The lightest eastbound volumes occur in Dedham. As in the AM, the PM peak hour traffic is directionally peaked, with the heavier traffic flow in the westbound direction. Westbound traffic increases substantially to the west of Route 128, with the heaviest traffic occurring in Westwood.

A license plate survey was conducted at five locations in the Route 109 corridor during the morning peak period on Tuesday April 9, 2002, to determine how traffic flows through the corridor. The data obtained from this survey was matched with the Registry of Motor Vehicles files to determine the community in which each vehicle is garaged (the origin community). Approximately 64% of all observed plates were matched. Plate match rates ranged from a low of 25% to a high of 95% for the individual locations. The margin of error for the origin data at the 95% confidence level ranged between $\pm$ 1.0% to $\pm$5.5% (the majority were under $\pm$3%).

The patterns revealed by the collected and analyzed survey data indicate the following:

1. Few vehicles travel the entire length of the study corridor during the AM peak period. For example, 2% of the vehicles initially observed at the westernmost survey location in Milford were also observed at the easternmost survey location in Westwood and 8% of the Milford vehicles were observed at the Medfield location

2. The majority of the traffic travels for short distances along Route 109 using it to access other arterials and collector roads such as Route 115, Route 27, and Dover Road.

3. Few vehicles (less than one half of 1%) leave Route 109 eastbound to use Village Street in Medway and Millis to by-pass Route 109. It appears that motorists use Village Street as a means to get to Route 109.

4. Hartford Street in Medfield and Westwood appears to carry by-pass traffic as approximately 30% of the vehicles observed at Hartford Street at Route 109 in Westwood originate in communities south of Route 109 and in communities that abut Route 109 south of Hartford Street in Medfield. Logically, these vehicles would continue on Route 109 once they reach the roadway. However, the majority, if not all, of them use Hartford Street to by-pass Route 109.

Several possible types of improvements were analyzed. They include correcting intersections of concern not yet covered by proposed or existing projects, alternative modes of transportation, park-and-ride lots, and pedestrian and bicycle facilities.

Intersection Improvements

Analysis indicates that traffic signals are warranted and will improve LOS at the now unsignalized intersections of Route 109 and Nahatan and Pond Streets and possibly (after further analysis) at Route 109 and North Street in Westwood. The signalized intersection of Route 109 (Main Street) and Franklin and Milford Streets in Medway currently operates at LOS F with lengthy delays on some approaches during both peak hours. Intersection problems are caused mainly by the jog in Route 109 and the heavy left turns. Signal timing and phasing modifications alone do not result in significant improvements. Geometric changes that might require additional right-of-way in some cases, could produce appreciable improvement.

Alternative Transportation Options

Several alternative transportation service options are available to individual communities or to a consortium of communities. They include a demand responsive transit service operating either during peak periods only or all day and fixed-route bus service from a remote lot to commuter rail stations, from commuter rail stations to corridor employment sites or from corridor communities to employment centers outside the corridor. Based on past experience in the region, typical ridership on a new service, assuming 1 vehicle operating a sequence of loops around a community throughout the day, would most likely range between 25 and 70 passengers per day, with 45-50 as the most likely average ridership. The actual ridership depends entirely on the specifics of the route or routes, the frequency of service, and the markets served.

The likely range of annual operating cost required, exclusive of the salary for an administrator/dispatcher, would be approximately $45,000 to $67,500 per vehicle for peak period service and $125,000 to $147,500 per vehicle for full day service. The value of the subsidy offered per rider would be approximately $2.50 to $12 per round trip (depending on type of service). In all likelihood, the primary support for these types of service would be town-generated funding.

Park-and-Ride Lots

The primary purpose of park-and-ride lots is to provide places from which commuters

could carpool to work. Informal observations suggest that commuters do not carpool for short trips because the transfer penalty represents a larger proportion of total trip time than it does for longer trips. The license plate survey and a CTPS traffic model assignment indicate that vehicles do not travel great distances along the Route 109 corridor and that trips are not lengthy. One way to provide local park-and-ride lots and test demand without a major investment in infrastructure is to contract with an entity such as a church or supermarket that has unused capacity in an existing lot.

Pedestrian and Bicycle Facilities

Roadway shoulders in the corridor, where present, are generally narrow-two feet wide. While sidewalks exist in six corridor communities, they do not run the entire length of any given community. Narrow shoulders and sidewalks that are not continuous are not particularly conducive to bicycling or walking (in some cases). Several improvement options are available, but they all require widening of shoulders and/or sidewalks.

6.2 Conclusions

Options that would neither change the existing character of the region nor require increased roadway capacity and or land-takings include the following:

1. Signalize the intersections of Route 109 and Nahatan and Pond Streets in Westwood.

2. Collect additional counts at the Route 109/North Street intersection in Westwood. Signalize the intersection if these counts indicate that the eight-hour vehicular volume warrant is met.

3. Upgrade the traffic signal equipment at the Main Street (Route 109)/Highland Street/Franklin Street intersection in Medway because of the age of the current equipment and the difficulty in finding replacement parts.

4. Given ridership that would be expected on a local bus service and the anticipated costs, individual communities or a group of communities should determine if there is interest in and potential funding for such service. If there is interest and resources, further analysis is required to determine the exact nature of the service, fares, possible routes, and an administrative structure.

5. Any corridor community interested in establishing a local park-and-ride lot should make arrangements with an existing entity to share existing parking spaces and thus test demand without incurring major infrastructure expenses. Perhaps the Brush Hill bus could service the lot.

6. Re-stripe crosswalks as needed.

Options that might change the character of the roadway or increase capacity on selected roadway segments include:

1. Make geometric changes at the Main Street (Route 109)/Highland Street/Franklin Street intersection in Medway

2. Widen shoulders and/or sidewalks where necessary and provide them in areas where they do not exist currently to accommodate bicyclists and pedestrians.